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RESEARCH AS IT IS TO-DAY[1]

LET my first words carry my warm gratitude for the kind and friendly thought which prompted the Johns Hopkins University to invite a French professor to speak here to-day. The Paris University, as the oldest in the world, feels itself to be, as it were, the grandmother of all others. This time-honored old lady is happy to see one of her younger offspring cheerfully celebrating her fiftieth anniversary. I am glad to bring you her most cordial congratulations and wishes.

For my part, I do so with all my heart, and I share in this beautiful celebration more as a friend than as a guest. It always seemed to me that some special affinity exists between the American and the French mind. I myself am quite at home among American fellow-workers, so easy is mutual understanding. I had this experience more than once; and to-day, on this unique occasion, amidst this unequalled audience, I feel it the more deeply.

Fifty years: only a start, a mere beginning in the career of a spiritual being like Johns Hopkins. Still how many valuable services have already been rendered to science and learning by this university! What a roll of glorious names it can show! To enumerate them does not belong to me. Better informed men are required to record that history. But I can not refrain from mentioning at least a few of the most illustrious men of science and scholars whose teaching and discoveries, from the first, established the prominence of Johns Hopkins: Ira Remsen, the chemist, whose admirable life has just been so vividly depicted before us; the far-famed physicist Rowland; for biology, Brooks; for medicine, Osler; for semitic studies, Bloomfield; for classics, Gildersleeve; and so many others whom I regret not to be able to mention in this address!

That so many eminent men met and worked here, during so short a lapse of time, that they made the name of Johns Hopkins renowned in Europe as well as in America, can not be attributed to chance. Obviously there were reasons for this luxuriant blooming of the new-born university. Under the guidance of its first president, Daniel Coit Gilman, Johns Hop-

[1] Address delivered at the fiftieth anniversary celebration of the Johns Hopkins University, at the exercises commemorating the opening of the new building of the School of Hygiene and Public Health, on October 22, 1926.

kins was at once organized "not so much for the purpose of passing on the rich heritage of past knowledge, as to discover new truth, and thereby extend the frontiers of the human mind." Conscious of the manifold aims it had to pursue, Johns Hopkins clearly conceived that the most important, the most vital and capital aim, which preceded all others, was the promotion of research. And not only it conceived it to be so, but it proceeded to act on this idea. Here lies the actual distinction and excellence of Johns Hopkins; here, the secret of its rapid rise and the promise of its future achievements.

Research, like many other human activities, has undergone some change in our modern world. It is no more the occupation of a few lonesome people. It is unceasingly going on in numberless institutes and laboratories, and its results fill a formidable array of periodicals. Thousands of men and women are working under all latitudes, from the Arctic Circle down to New Zealand. All have a claim on our esteem and praise, since every one, even the most pretentious, enlisted on science's service, devotes to it whatever ability and skill he or she possesses. But evidently all kinds of research do not stand on the same level. A great many laboratories are appropriated for the advancement of what the Germans call *die Technik,* that is to say, the most satisfactory combination attainable of practical aims and scientific means. Our arts and manufactures are continually confronted with many problems which are amenable to this research, some of a very wide range, others more or less narrow. Suppose, for instance, the remaining quantity of coal in the world was known and likely to be exhausted in a given number of years, the question is to discover a substitute for it and meanwhile to find out the best use we can make of it. The same problems arise for oil and all the valuable materials which mankind, until now, really did not consume but wasted.

This kind of research chiefly aims at a rational employment of the natural resources at our disposal. It has proved faithful and is well worth the united exertion of a host of investigators. It permits a division of labor; such problems may often be divided into more and more minute questions which, in order to be solved, require only time and painstaking and professional skill. In some branches of the chemical industry, scientific research may be said to be in reality "taylorized."

On a different and somewhat higher plane, another kind of problem appears which is not properly technical, although forced upon us by actual and sometimes dire necessities. Here trustworthy methods, skill and a staff of experienced workers can no longer suffice. Something more is required, which only an inventive turn of mind is able to afford. Shall I report a striking case in point? About sixty years ago, the Rhone Valley in France was threatened with an awful calamity. An unheard-of disease was killing the silkworms, and the silk industry was on the verge of destruction. No remedy could be found: what was to be done? As a last measure, the despairing people resorted to the great biologist Pasteur, entreating him to try and save them. He consented to study the problem. After several months of strenuous work, which endangered his life, he fortunately discovered the cause of the disease and at the same time the means to prevent it. Thus the silk industry was saved.

Although in this fight with immediate problems we are far from always getting the better of them, it is worthy of note that men of science never lose heart. Failure is only an incentive to try again. When research has made sufficient progress, they even take the offensive, and move forward to the extermination of the worst scourges of human life. Who can forget how yellow fever was wiped out of Panama and Cuba? How malaria is victoriously contended with in many countries? Against tuberculosis and cancer, here, as in Europe, a holy war is being waged, and there will be no armistice until the foe is done away with.

Such researches deserve the attention of the clever men and women who give themselves up to it. They make life easier and more bearable for all. They often succeed in allaying the pains of those who suffer, and occasionally defeat "immature death," which the Latin poet Lucretius bewailed, thinking that it was not ever possible to beat it back. It sometimes happens that they lead to capital discoveries. Nobody would grudge the praise, the credit due to them. Yet it must be admitted that what they aim at, and often achieve, is an extension rather of our power than of our knowledge. They do not very often open new vistas for science. They do not help very much to make us better acquainted with the secrets of nature and the intricacies of phenomena.

To investigate the latter is the exclusive object of still another kind of research, which tends to pure science. Its only aim is the discovery of truth, without any reference to actual needs. Its problems are not propounded to or thrust upon it by practical necessities. They emerge from the present state of the sciences at every moment. Each new discovery is but a stepping-stone to higher questions; for what pure science endeavors to gratify is an unquenchable thirst for more knowledge. This pursuit of scientific truth for the sake of truth itself, and nothing else, may be called the highest form of research. It is research *par excellence.* Historically, it was the origin and the real

nerve of all other kinds of scientific research. It gave them their life and nourishment. Failing this genuine craving for truth, failing pure theoretical research, all applied sciences would be doomed to deteriorate and perhaps sooner or later to end in mere empiricism.

Fifty years ago, when Johns Hopkins was founded, there was little need to voice these almost self-evident notions. To-day they are somewhat obscured, in consequence of the very development of both theoretical and applied sciences. We have beheld a splendid advance in physics, in chemistry, in biology, not to forget the vast realm of mathematics. This progress, in its turn, has made possible the marvelous conquests of applied sciences. Then such has been the profit and the renown of these latter that theoretical sciences find themselves a little in the shade.

No one is responsible for this inversion of values. In the present state of affairs it was not to be avoided: so many causes were leading to it. Pure theorists are fewer and fewer, compared with the growing number of workers in applied sciences. Beautiful discoveries in abstract sciences are nearly always out of the reach of the uninitiated, while achievements in applied sciences not only happen much more frequently, but also strongly appeal to the public imagination. And they seem to be so much more profitable! Every man in the country can appreciate the benefit of the wireless, the airplane and so many astounding inventions—incredible wonders for our parents, commonplaces for our children. But how few can perceive that the recent discoveries pertaining to relativity, atoms, radioactivity and so on are more momentous and of wider consequences. Yet nothing is more true, and perhaps it is not untimely that public opinion should be reminded of it.

It was said, long ago, that when the first Greek geometricians were studying the conics, nobody could have the faintest idea that, many centuries afterwards, the purely theoretical truths they were digging up would save innumerable sailors' lives. Before them, Egyptians had arrived at some technical knowledge in geometry and mechanics, of which they availed themselves to build their temples and pyramids. But, as Plato says, with some irony, that was a science of merchants, not of geometricians. To be sure, it could never have led either to astronomy, such as the Greek created it, as Copernicus, Kepler, Newton and Einstein enlarged it, or to the physical and biological sciences such as we possess to-day. Consequently, had not the Greek philosophers, mathematicians and physicists been at work, the whole of the applied sciences, which our civilization boasts of so proudly, would have remained non-existent and not even imagined. All our engineering, all the huge mass of our multifarious industries has its root in the disinterested and purely theoretical research of a few men of sciences in a petty corner of the west, some twenty-four centuries ago. To their more practical contemporaries, very likely, they cut the figure of dreamers, queer and harmless people, idly poring over meaningless lines and figures. Thus history warns us against the temptation and danger of rating the rank and value of the various kinds of research according to their immediate and apparent usefulness. Ought even utility be our standard at all? Aristotle thought that metaphysics was the most beautiful of sciences, because the most useless. Had he known of our pure mathematics, physics, chemistry and the rest of our theoretical sciences, he would not have debarred them of a similar praise. Disinterested pursuit of truth, untiring struggle with the mysteries of nature are the lasting honor and dignity of our species. To give them up, even if they were practically useless, would be tantamount to losing what in us is preeminently human.

But indeed pure science, far from being useless, is generally sure to become, in the long run, the most useful of all. When an invention, either big or small, comes forth, we may, without much difficulty, calculate what is to be gained by it. But when new laws of phenomena are disclosed, when, for instance, radium is discovered, who can guess at once the far-reaching consequences, and what other discoveries may follow, adding unexpected provinces to our empire over nature? The potential utilities of disinterested research are unbounded and at first unmeasured. Therefore, though the most abstruse and theoretical science looks sterile, it is not. Likewise, snow-clad peaks and lofty ranges seem to be barrenness itself. Yet therefrom mighty rivers take their rise, and to their waters the rich lowlands partly owe their fertility.

So it was an unerring instinct, or, better said, a far-reaching insight, which led the Johns Hopkins to assign to itself as its goal research under its various forms, and more especially pure science.

It is evident that such a place must not be crowded and should be more of an assembly of seminaries than of a complex of large colleges. However interesting and clever lectures and courses may be, the young adepts in sciences, the physicists, chemists, physiologists, etc., in the making, do not want to sit at them by the hour. They have entered another period of their training. What they must get now is personal intercourse with the leading men of their science, in order to partake of their daily work in their laboratory or library. As they are in the process of evolving from pupils to fellow-workers, such an intimacy with the masters is the sole teaching they need. In this way they will acquire not only accurate knowl-

edge, the habit of strict reasoning and the distrust of too easy and delusive explanations, but also, and above all, the craving for new truth, and that polarization of the mind, if I may say so, which shapes it into a fit implement for research and discovery.

Some—indeed very few—are born men of science. Others achieve such a vocation; only they must be helped to it. Scientific genius appears where and when it pleases. Nature is not prodigal of wonders like an Archimedes, a Newton, an Einstein. All we can do is to look up to them as they shine and to give them any means of work they may want. But nature also brings forth, in every age, a variety of original and productive minds, which, though no stars of the first magnitude, are capable of contributing to the advancement of sciences. These must be encouraged, informed, developed in a congenial atmosphere. It is for such young men that a university like Johns Hopkins seems designed.

Were the spirit of disinterested research to get strength, we might hope to see it gaining new ground, and more and more penetrating the study of a wide range of phenomena which, hitherto, have been the object of an immense amount of labor, but not in the same way as men of science are wont to work. Up to this day, moral and social sciences have hardly been sciences, in the strict sense of the word. Many reasons explain the fact, and, in the first instance, the peculiar nature of their subject-matter must be taken into account. Wherever human interests, feelings and passions are directly involved, the serene objectivity which science can not do without becomes exceedingly difficult to attain, and, when attained, to keep up. Mostly the conflict of opinions, either outspoken or tacit, makes the unbiased analysis of facts a sheer impossibility. Had mathematics, in the eyes of men, the same kind of interest as politics, perhaps mankind would never have known what truth really is. Who would gainsay this deep thought of Spinoza? Let us rather go to the bottom of it, and say, in our own turn, that not until we look at social facts as we do at physical ones, shall we discover scientific truth about them. Certainly molecules, cells and the like are more easily viewed with dispassionate eyes than labor problems or competition between nations. Still, should the spirit of disinterested research get a firm footing here, we might expect much from its efficiency.

Until now, human communities have had to be content with the traditional wisdom and ability of their leaders. However gifted and clever these may be, their empirical skill can not in every case make good the deficiency of scientific knowledge. Under very unusual circumstances they may be baffled, and out of their depth. Then highly civilized nations grope in the dark and blunder into hateful wars. It is generally said that blind collective impulses are chiefly responsible for that horror. Granted; but ignorance has its share in it and keeps the passions alive. Perhaps, when Johns Hopkins celebrates its thousandth anniversary—if it is not too bold to anticipate so much—people will at the same time admire and pity us, supposing they think of us at all: admire what our time achieved in abstract and applied sciences, but pity our astonishing ignorance of the laws of social phenomena and the loathsome evils we are consequently muddling through.

Can a stronger reason than this be conceived to keep up the spirit of disinterested research, to shelter and to defend it against any danger that might threaten it? Extreme poverty is fatal to it; wealth has also its drawbacks. Shallowness is irreconcilable with the true spirit of research, but a too narrow specialization may smother it. The latter hinders the soaring of the imagination and discourages the daring necessary to the seeker for new truth. If his eyes remain servilely riveted on a given series of facts, he has little chance of rising to an unexpected hypothesis, which generally should imply the bringing together of facts hitherto considered apart. To this the history of sciences testifies. As often as not, original discoveries are due to men whose work had begun in another field. Pasteur, for instance, if I am allowed to name him again, who originated a momentous revolution in pathology and therapeutics, had not graduated in medicine. He started with merely chemical researches and was led by degrees to his famous biological discoveries. Thus every one of the young pioneers of science ought to be enabled to dig his own hole and at the same time to survey the surrounding ground.

I can not attempt here to draw even a summary sketch of what the education of an ideal man of science should be. Yet there is still something that must not be left unsaid. I conceive him to be a man of his own time and rather a harbinger of the coming age than a representative of the bygone ones. He is also to be thoroughly human, and therefore never exclusively engrossed by his own special work, though he gives it his days and sometimes his nights. I see him eager for every noble cause, responsive to the great calls of his age, and endowed with a beautifully furnished mind. He is no stranger to the invaluable treasures which the ancients bequeathed to us. Their poetry, their philosophy appeal to him. He finds therein a matchless refreshment, which makes him the more keen-witted, the more clear-sighted for his own investigations.

This is no fanciful picture. I have an actual model for it in my mind's eye. I mean that admirable man

of science, Sir William Osler, whose spirit animated a part of this university and still lives in it. Never was a man more completely devoted to his chosen research; and yet, how alive to the moral needs of his contemporaries, how full of human kindness, how intimate with classical and modern poets! May many such accomplished men of science meet in this university so fit to welcome them, may many rise out of it, doing good service to mankind and honor to their country!

L. Levy-Bruhl

University of Paris

THE MEDICAL SCHOOL A PROFESSIONAL SCHOOL OF SCIENCE[1]

The zero hour has come. At least, being no orator, I have much the feeling usually attributed to that momentous occasion. Selected on the basis of seniority and obedient to command I extend the call to medical graduates to go over the top in a new advance in the age long war of experimental science against credulous adherence to tradition. In this war it was the privilege of the Johns Hopkins University to establish the first school for officers in this country and thus to make a new declaration of independence one hundred years after the first, a declaration of intellectual independence.

Her graduates have gone to all parts of the country to aid in the development of American universities as institutions for the advancement as well as the diffusion of knowledge. Many of these graduates have returned here to-night to celebrate the fiftieth anniversary of their alma mater and at the same time to bring with them the cordial greetings of the institutions with which they are now connected. These institutions are so numerous that a personal public tribute from each is impossible at this time. I therefore desire to extend in behalf of the medical graduates engaged in teaching the heartiest expression of good will from their respective faculties.

As an example of the kind of tribute which each would like to pay if time permitted, I desire personally to extend the greetings of the university with which I have been connected during the past twenty-two years, the University of Wisconsin. During the early years of the Johns Hopkins University, Wisconsin, then essentially a college, sent many of her graduates here for advanced training. During the eighteen-nineties Wisconsin became a university by developing extensive facilities for graduate work and research. In the process of university development Wisconsin called upon the Johns Hopkins for numerous leaders, including such men as Richard Ely and W. A. Scott in economics, Moses Slaughter in Latin, Charles H. Haskins in history and Joseph Jastrow in psychology. Some of her own alumni who took a leading part in this university development, such as Frederick Turner in history and H. L. Russell in bacteriology, had graduate work at the Johns Hopkins. Robert Wood, trained here, made his mark at Wisconsin before returning to continue a brilliant career in physics. When the medical school at Wisconsin was established early in the present century, the Johns Hopkins Medical School was called upon to furnish men to head several departments. The furnishing of leaders for educational advance has not, however, been entirely one-sided. Wisconsin was called upon to sacrifice Carl C. Thomas when the Johns Hopkins established the school of engineering and E. V. McCollum when the Johns Hopkins established her School of Hygiene and Public Health.

Many similar illustrations might be given of what the Johns Hopkins has meant to other institutions during the past half century. To use a medical metaphor, she has been a thyroid gland, the products of which at first helped to ward off cretinism in our institutions of higher learning and to-day help to ward off myxoedema.

I am asked to-night to discuss the next half century of the university from the standpoint of the medical school. Unfortunately, I am not only not a prophet, I am not even a clinician accustomed to giving professional prognoses properly protected. Were I to regard myself as a clinician of medical institutions, I should have to regard myself rather in the light of an obstetrician and pediatrician than in the light of a geriatrician to be called in to give a health examination to a lusty individual of fifty whose only complaint appears to be a tremendous appetite, and whose ideas of a balanced diet are millions for philosophy against millions for medicine.

The success of the Johns Hopkins during the past fifty years, however, has been due not to abundance of material resources but to adherence to ideals, to vitamins rather than to calories. Among the more important of these vitamins I take to be:

Vitamin A: Let practice preach.
Vitamin B: Live leaders, not monumental mortuaries.
Vitamin C: Achievement, not acquirements.
Vitamin D: Individuality, not institutionalism.
Vitamin E: Service to science, for light not lucre.
Vitamin F: The future foremost.

These vital principles we all desire to see continued during the next fifty years, however the course of our civilization may trend. It may pay us to consider each a little more in detail to illustrate its meaning.

[1] Address delivered at the fiftieth anniversary banquet of the Johns Hopkins University, October, 1926.

Vitamin A: Let Practice preach

The Johns Hopkins has always been more interested in the study of her own opportunities and in the development of these opportunities than in telling others what they ought to do. This is probably a chief factor in the great influence which she has had upon the development of higher education in America. Example excites emulation.

By showing the value of standards of achievement in place of standards of acquirements in the mathematical, physical, biological and social sciences she succeeded in establishing for our colleges in place of the practice "Who can not preach, teaches" (with due apologies to Bernard Shaw) the standard "To teach, produce at least a doctor's thesis."

By showing the value of special training for matriculation in the medical course, preclinical teaching in the hands of specialists, clinical teaching in a hospital under medical school control, the obligation of the medical school to advance knowledge and to give clinical teachers more freedom for research, she has contributed much toward the transformation of the standard American medical college from a cheap trade school into a costly academy of science.

By organizing the School of Hygiene and Public Health, she has recently emphasized the need of having more knowledge in a field of great popular activity: brains to direct, where heart inspires.

In the proposed School of International Relations, in the proposed changes in the plans for the School of Engineering, she is directing her steps into fields now lacking development, among the other fruits of which there will doubtless be new aids to health.

In the move to give up elementary college teaching the Johns Hopkins is, I believe, wise. This work when first established served a good purpose. It may now be entrusted to other hands. The Johns Hopkins should ever be ready to drop work which other agencies, public or private, can do as well, in order to concentrate her resources in directions in which they are more greatly needed. If, during the next fifty years, it should be found that the undergraduate medical course is less needed than purely graduate work in medicine, I hope that the medical graduates may acquiesce in the same good spirit shown by most of the graduates of the college course toward the giving up of elementary college work. To alter the well-known lines of Pope:

In plans for future the sane rule will hold
Fear not adventure with new or old
Be ever first by whom the new is tried
And ever first to lay outworn aside.

Vitamin B: Live Leaders not Monumental Mortuaries

The simplicity of the physical plant and the inspiring vigor of the faculty of this university in its early days under the leadership of Daniel Gilman is an oft told tale. Even in 1893 when I came here to study medicine, attracted by the reputation of the graduate school and by the announcement of the opening of the first medical school in the country on a graduate basis, I found the physical plant of the academic part of the university most disappointing and that of the medical school still more so. For aside from the hospital, in which work was not to begin for two years, there literally was no medical school in the physical sense. Some temporary quarters for dissection and physiological chemistry were being fixed up in the old pathological laboratory of the hospital but were not yet completed. The Women's Fund Memorial Building for anatomy and pharmacology was not completed until the following year. It was six years before physiology was transferred from the old biology building to the physiology building. We were given space in the quarters provided for undergraduate students in biology and were given an intermediate status between graduate and undergraduate students. We did not know how to behave as graduate students and resented being treated as undergraduate students. In spite of the grand simplicity of W. K. Brooks, who taught us osteology, before the year was well advanced about half the class resolved to leave and go elsewhere for medical work. Dean Welch heard of this, asked us to come around to his room to talk things over, gave us cigars, explained the difficulties of starting a new school, asked for our cooperation and persuaded us to stay on. It is needless to say that all of us have since been grateful for the advice. With what envy the hundreds of applicants who are now denied admission each year must look upon those early days when students once admitted had to be persuaded to remain.

To all our instructors we of the early classes are each of us to-day, a generation later, profoundly grateful for the friendship shown and the inspiration offered.

I am personally especially indebted to Franklin Mall, with whom I spent ten years as student assistant, instructor and associate and whose friendship I shall always prize as the most inspiring of my life.

Other students of these early classes were similarly enriched and inspired by special intimacy with other members of the faculty. Fortunately, many of the members of the early faculty still lend inspiration to the medical school either directly or indirectly through the sister school of hygiene, and are with us here

to-night. Of these men I shall say nothing now, although my heart, as I am sure the hearts of all medical men here, goes out to them with warmest gratitude.

Of those no longer with us I shall refer briefly but to two, W. S. Halsted and William Osler. Halsted, like Mall, was a man of delightfully modest character richly endowed. His talent as a teacher is best attested by the large number of scientific surgeons who last fall formed the Johns Hopkins Surgical Club. Halsted, while like Mall in modesty, originality and individuality, was essentially an aristocrat while Mall was exceptionally democratic. I well remember walking along the hospital corridor with another student desirous of ingratiating himself with Halsted, who was walking just ahead. This student put his hand on Halsted's shoulder and tried to start a friendly conversation with "Professor." He got no further. Halsted turned, looked him up and down and said, "Don't call me 'professor.' I'm no damned dancing master."

Of Osler it appears presumptuous to speak on this occasion. He has had in Harvey Cushing's biography too magnificent a tribute paid to him to justify a brief eulogy from me. And yet there is one thing sometimes overlooked that Osler helped to emphasize. Medicine is an art as well as a science. A medical faculty to be well balanced needs men of the artistic as well as the scientific point of view. The strength of our early faculty lay in the fact that we had on it not only men of exceptional scientific gifts like Mall and Halsted but also a man of exceptional artistic gifts in Osler.

For the leaders we have lost the medical school is a monument, not of work buried but of work rich with the vigorous life which they inspired.

VITAMIN C: ACHIEVEMENTS NOT ACQUIREMENTS

The most characteristic feature of higher education as developed at the Johns Hopkins, the greatest contribution which the university has made to education in America, is the spirit which leads every member of the faculty, every graduate, every student, to feel an obligation to contribute to the advance of the work in which he is engaged beyond the extent to which his own welfare is involved. Achievement is placed ahead of acquirements.

On the other hand, the acquirement of a bachelor's degree (no one can call this an achievement) has thus far been a condition for taking up advanced work at the university. I believe that a distinct step in advance has been taken by the philosophical departments in planning to admit to advanced work students who have had requisite special preparation irrespective of whether or not the student has a college degree. While there may be legal difficulties involved in the deed conveying the original endowment of the medical school, I should like to see a similar liberality displayed in the matriculation requirements of this school. As a preparation for the practice of medicine prolonged withdrawal from the world within college, medical school and hospital walls has serious disadvantages. The patient as such is only half a patient. The other half is his environment. A student too long withdrawn from ordinary human surroundings is likely as a clinician to have difficulty in viewing the patient as a whole.

A somewhat extreme view of the effects of too prolonged a training divorced from practical affairs has been voiced by an active medical representative of a state which has not yet officially succumbed to fundamentalism:

> Men come into our state from Johns Hopkins. We have a number of new members on our faculty.—They were inducted into the faculty because they knew enough of the sciences to get in and God knows that is all they do know. Not a single member probably knew there was a medical society and do not seem to know there is a medical profession.—They are like automatons. They never respond to the glorious things in medicine—any more than a plumber in handling his dead material. —[They escape] the thrills that come to you and me from the glorious privileges that are permitted to us.

With all due allowance for the exaggeration displayed, I believe there is here a grain of truth. Society as well as science should mould the medical course.

VITAMIN D: INDIVIDUALITY, NOT INSTITUTIONALISM

Freedom from the burdens of organization, freedom of the individual for independent work were features of the early days at the Johns Hopkins which favored original research. Among the most productive days of the medical school were those of its nine years of gestation, from 1884, when Professor Welch took charge of the department of pathology, until the opening of the school in 1893. Those were the days when, for instance, the men were trained who subsequently laid the scientific foundation for the eradication of yellow fever from America.

When the medical school was opened in 1893, there were introduced pedagogical and clinical duties which tended to restrict freedom for scientific work for teachers of these subjects as compared with those devoting themselves to various special branches of knowledge such as advanced physics or chemistry. In spite of this fact the medical school has from its origin distinguished itself for its scientific productivity. Various expedients have been devised to pre-

vent routine pedagogical and clinical duties from unduly interfering with scientific work, limitation of size of classes, limitation of the portion of the year to be devoted to routine teaching, large teaching staff, full time professorships. In the old days there was no danger from burdens of elaboration of physical plant. The total endowment of the medical school was but a fraction of the endowment necessary merely to heat, light, keep clean and in repair a medical school building recently completed for another university. With the increase of facilities made possible by gifts in recent years and hoped for in the future there is ever the danger that scientific liberty may be hampered by elaboration of institutionalism. This danger should be carefully shunned. To return to a previous metaphor, we do not want the medical school to develop goiter.

Vitamin E: Service to Science, for Light not Lucre

Training of professional scientists as the highest duty of the university has in practice been recognized by this university from its foundation. The times have been propitious. Specialization of occupation has been rapidly developing in this country during the past fifty years. When the Johns Hopkins was opened there were comparatively few opportunities for a professional scientist to find a full time position as such. There soon developed, however, opportunities to combine this profession with the profession of teaching, with various administrative duties or with other work not overloaded with time-consuming routine. To-day there are numerous openings in endowed research institutes, governmental and industrial establishments and other places for the professional scientist and the number of such places is likely to increase rapidly in the future. We hope, therefore, to see the university continue to make its chief aim the training of students to advance science.

In no field is this more important than in the field of medicine and hygiene.

When the Johns Hopkins was established but little attention was paid to public health. Sickness was an individual affair. Shakespeare's version of the seven ages of man still applied. To-day man enters upon the stage a little earlier and leaves a little better equipped, as described by Dr. Bryant:[2]

> The prenatal clinic cares for the baby in the mother's womb and guides it into a hostile world. It is received in the motherly lap of the baby welfare clinic and tenderly cared for. It receives its nourishment from the warm and hygienic bottle prepared in the baby milk laboratory. Its tottering steps are guided by the helping hand of the child welfare society. In due time, the child enters school, and he is welcomed on the threshold by the school nurse and introduced to the school physician. He is vaccinated against smallpox, inoculated against typhoid and is given the Schick test. His teeth are looked after at the dental clinic, and his tonsils and adenoids removed at some hospital out-patient department. His eyes are examined and possibly fitted with glasses. Thus prepared and equipped, he at once starts to do his health chores. Found underweight, he enjoys for a time the luxury of an open-air school under the supervision of the nurse and physician of the anti-tuberculosis association. Thus, he is guided through school and may take a chance at college. If he here escapes for a moment from his guardians and falls into evil ways, there are free clinics provided, even for these emergencies.
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> Safely passing health inspection and eugenic examinations, wedlock is entered. In due time, his wife becomes an attendant of the maternal welfare clinic. His health is guarded by periodic health examinations. He is looked after at his work by the industrial nurse and prescribed for by the industrial physician. If sick at home, he has the care of the visiting nurse and the social worker. His future is provided for by his industrial insurance and old age pension. In his declining years, he enters some rest home for the aged. His dying pillow is smoothed by the institution nurse and his room brightened by the home visitor. Some burial society looks after his funeral. At last, he lies at rest, after a long and pleasant journey along the free health road. Even heaven has been made sure, and the ministering angels will continue to guard him through all eternity.

[2] Bulletin, American Medical Association, November 15, 1922.

The movement to socialize medicine and hygiene thus graphically painted has behind it many agencies, private and public. We find in the medical profession, where on the whole the spirit of individualism survives more than in any other important social group, a vast unrest and considerable resentment against the invasion by outside forces of the field of work which physicians regard as properly their own. There are ahead great problems to be solved involving not only the advancement but also the application of medical knowledge.

Vitamin F: The Future Foremost

President Eliot, I believe, once said that a good teacher has either to be young or one who has never grown old. This is likewise true of educational institutions. The topic assigned to the speakers to-night, the Johns Hopkins 1926–1976, the warning which we have all had, to deal with the future not with the past, shows the direction in which the university is still aimed, as it always has been aimed, ahead not backward. Even the deepest students of classical antiquity of her faculty, as Professor Laing

has shown, are at heart more concerned with contributing to the future scholarship of the world than with becoming lost in the past.

In the physical sciences the startling advances in recent years make the future appear particularly alluring. But it is in the field of biology, as Professor Conklin has shown, and in studies of the immediate life of man, including medicine and hygiene, that the next fifty years offer the promise of greatest returns.

In scientific philosophy devitalization of life is yielding to vitalization of the universe. In biology the chief center of interest has shifted from description and classification, through mechanistic abstraction, to life as lived. In scientific medicine the chief center of interest has passed from the autopsy room through the clinical laboratory to the common health. The nihilism of terminal medicine is yielding to faith in the stitch in time.

Details as to what the next fifty years may offer in aims, means or results in science I shall not attempt to discuss. Those who enjoy letting fancy rove are referred to Francis Bacon's description of Solomon's House written three centuries ago. It will doubtless take another three centuries for the experiments of light to obtain the relative position there pictured. To-day the experiments of fruit enjoy the luxuries, and these are far beyond those dreamed by Bacon.

The luxuries awarded to applied science are nowhere more in evidence than in the field where the movie heroes love the great open spaces. It is to be hoped that in the future heroes endeavoring through experiment to throw light on vital activity may be granted more use of great open spaces. It is significant that state agricultural experiment stations furnished two leaders to our School of Hygiene and Public Health. The work of the late Luther Burbank, foremost of experimental breeders, shows the need of experimental genetics studied on a broad scale. The work of Henry Ford, foremost of experimental sociologists, suggests the value of experimental study of environment on human life. The example of William Mayo, foremost of experimental practitioners, shows the importance of having more space than civic centers allow for experimental studies in the medical sciences. It is noteworthy that the foremost experimental pathologist, Theobald Smith, has always recognized this. The Johns Hopkins should add to its official program for the immediate future the purchase of a tract of land near Baltimore and an endowment for experimental biology and medicine in the open.

In this era of specialization institutions as well as individuals have been becoming more and more specialized. The medical school of the Johns Hopkins University, relatively free from direct social responsibilities, may best make its chief duty the advance of medical science. The medical school of the University of Wisconsin through university, school system and state government, an organic part of the commonwealth, must devote relatively more attention to medicine and hygiene as social arts. Neither school can afford to neglect either the science or the art of medicine, but differentiation and specialization according to responsibilities and opportunities are likely to lead our medical schools and other educational institutions into their respective greatest fields of usefulness.

To sum up: My prayer for the Johns Hopkins Medical School of the next half century is abundance of freedom for the development of scientific research as an independent profession, abundance of means for developing this freedom.

For the realization of this hope ample funds are needed. Gifts to endow free care have seldom been a continued public benefit. Charity should not only begin at home but should represent a sacrifice by those immediately cognizant of its needs. Gifts made to endow schemes to save society are likewise doomed to ultimate failure. Fashions change. Gifts made to endow advancement of knowledge and gifts made to promote perfection of expression of aspiration are the most beneficent contributions of philanthropists. These have made possible mankind's truest treasures, the works of the creative imagination. It is to be hoped that the day may come when the Johns Hopkins may receive gifts which will enable her to develop creative achievement not only in the realm of science but also in that of fine arts. Freedom for both seekers for beauty and seekers for knowledge is needed to release the truth that liberates. *Veritas nobis est liberanda.* It's up to us to see that truth is freed.

C. R. BARDEEN
UNIVERSITY OF WISCONSIN

THE ANNUAL SCIENCE EXHIBITION OF THE AMERICAN ASSOCIATION

THE continued development of the annual science exhibition held in connection with annual meetings of the American Association for the Advancement of Science is showing pronounced activity this year. Those who have attended the last five annual meetings will remember that the exhibition has been a regular part of each meeting since the project of an annual exhibition was taken up at the second Toronto meeting. Through the unusually excellent work of the local committee for that meeting (December, 1921), the first exhibition of this annual series was a remarkable success. The next exhibition, at Boston, was not

so satisfactory in some ways, but it carried on. The one at Cincinnati showed great improvement in the number and importance of the exhibits, although it was not so attractively arranged as was desirable. In these first three cases the exhibitions were held without collecting any funds from the exhibitors (entry of exhibits was free to all), the services of those in charge were all contributed gratis and very little if any money was spent by the association. The Washington exhibition (December, 1924) was much larger and more satisfactory than any of the earlier ones in the series. Exhibits by commercial firms were more numerous and more complete than ever before and the gymnasium of the George Washington University was thoroughly filled. For the first time, the commercial exhibitors joined together in contributing a small fund to care for exhibition expenses, but not much was needed; this, as well as the earlier exhibitions, was distinctly "home-made" in style. Considering the limited financial possibilities and other limitations, due to the fact that the exhibitors and those in attendance had only begun to realize the great possibilities of the annual science exhibition, that Washington exhibition was a mile-stone. Its success was mainly due to the efforts of Mr. W. J. Showalter and his coworkers on the Washington local committee, and to the devoted services of Dr. Chas. A. Shull, who had the then new responsibility of securing exhibits. A separate catalog of exhibits was prepared and published, through the assistance of Dr. Sam F. Trelease and Dr. Earl S. Johnston. The idea of making the annual American Association science exhibition a prominent feature in American science began to take form from these crude and limited beginnings.

For the next exhibition (that held at Kansas City last year) many new departures were introduced and this feature took on, for the first time, the characteristics of an outstanding part of the annual meeting. The management of the Kansas City exhibition was placed in charge of Major H. S. Kimberly, who devoted much time and energy to it. Those who attended the Kansas City meeting will not forget the very attractive and valuable exhibition, in the ball-room of the Aladdin Hotel, with its New-Year's-Eve entertainment, its service of afternoon tea and its extensive displays of both commercial and research science. At Kansas City the exhibition was first placed on a proper financial basis by having a regular schedule of rates charged for space occupied by the commercial exhibits. A large number of apparatus firms and publishing houses cooperated by taking space, and the remarkable success of the exhibition was fundamentally due to the help they thus gave to the association. About $2,000 was expended on the exhibition, without drawing on regular association funds. This was another mile-stone in our progress; the aim of having a really extensive, well-arranged and attractive science exhibition in connection with the annual meeting had been achieved.

Plans for the science exhibition at the approaching fifth Philadelphia meeting of the association and associated societies have now gone far enough to warrant the safe prediction that it will greatly surpass the Kansas City exhibition in every way. Its financial success is already assured, through the many commercial firms that have contracted for space and the exhibits of those firms will be finer than ever before. The gymnasium of the University of Pennsylvania (Weightman Hall, at Spruce and 33rd Sts.) affords much more space than we have ever had previously, and it will be well filled.

The annual exhibition is in charge of the committee on exhibition, the members being as follows:

H. E. Howe, *chairman;* editor of Industrial and Engineering Chemistry, Mills Building, Washington, D. C.

C. E. K. Mees, of the Eastman Kodak Company, Rochester, N. Y.

L. M. Potter, of the Spencer Lens Company, Buffalo, N. Y.

M. E. Leeds, of the Leeds and Northrup Company, Philadelphia, Pa.

J. Edward Patterson, of Arthur H. Thomas Company, Philadelphia, Pa.

In addition to these, who represent the exhibiting firms as well as the scientific interests of the association, are the following *ex-officio* members:

L. H. Bailey, president of the association.

Burton E. Livingston, permanent secretary of the association.

H. S. Kimberly, manager of the exhibition.

The secretaries of the sections of the association are consulting members of this committee. All moneys paid into the exhibition fund are cared for by the Washington office of the association and all disbursements for exhibition expenses are made from that office. The accounts are a part of those of the association.

The section secretaries were asked last spring to canvass their respective fields of science and furnish the committee on exhibition with suggestions, especially with reference to the research aspect of the Philadelphia exhibition. It was hoped that the sections of the association might generally each be represented in the exhibition by demonstrations of some recent and outstanding advance in science. Not much came of that attempt to secure suggestions and it became necessary for the committee on exhibition to undertake to select some exhibits to be invited for this

very important part of the undertaking. Exhibits by individuals and research laboratories are being arranged, by invitation. The committee welcomes concrete suggestions as to exhibits that might be requested. No fees are to be paid on account of these invited exhibits, the expenses of the exhibition being covered by the fees from the commercial exhibits. Individuals having newly developed apparatus or methods, etc., suitable for the Philadelphia exhibition should make inquiry from the permanent secretary's office immediately; in some cases these exhibits may be placed in the main exhibition hall. If necessary, a separate room is to be arranged for an overflow.

A number of the societies associated with the association will hold small, technical exhibitions in connection with their sessions at Philadelphia, and exhibits by individuals may, in many cases, be accommodated there. The societies have been requested not to enter commercial exhibits in their society exhibitions unless the exhibitors have taken space in the great, general exhibition for all science. The local committee at Philadelphia is arranging rooms for society exhibitions as well as for sessions.

Arrangements for exhibits by commercial firms are to be made with the manager of the Philadelphia exhibition, Major H. S. Kimberly, who is to be addressed at the association office, in the Smithsonian Institution Building, Washington, D. C. Some spaces are still available.

The registration offices for the Philadelphia meeting, in charge of the executive assistant, Mr. Sam Woodley, will be located in the central portion of the large exhibition hall (Weightman Hall, Spruce and 33rd Streets). The offices will be open from 9 to 6 daily, throughout convocation week. The visible directory of those in attendance will be arranged as usual. The news offices, for releases to the daily press, in charge of the director of news, Mr. Austin H. Clark, of the National Museum, will be located in the same building, on the floor below the general exhibition.

There will be one or more evening entertainments given by the commercial exhibitors, especially a Christmas-tree affair on Tuesday evening, December 28, and a New-Year's-Eve gathering on Friday evening, December 31. The general exhibition will be a social center for the meeting. Tea will be served every afternoon.

Burton E. Livingston,
Permanent Secretary

SCIENTIFIC EVENTS

BIOLOGICAL RESEARCH IN RUSSIA

Professor R. Ruggles Gates, who has returned to London after a visit to Russia, gives, in a letter to *Nature,* some interesting information as to the position of scientific work and institutions there. In the course of his letter he says that much valuable work is being done in the various plant-breeding stations which he visited. These included Tammisto, near Helsingsfors, Finland, as well as Khibiny in Russian Lappland, north of the Arctic Circle, which is devoted chiefly to the production of northern vegetables and oats for fodder; Peterhof and Desto Selo, near Leningrad, where extensive genetical, biometric, cytological and physiological investigations are being carried on, especially with cereals, under the direction of Professors Philiptschenko, Vavilov and Levitsky, and Drs. Pissarev and Karpetschenko; Petrovsky-Razoumovsky, where extensive experiments, particularly with oat-breeding, are being made by Dr. Schegalov, and Saratov, where the greatest interest attaches to a series of unique wheat-rye hybrids of Professor Meister and where Dr. Plachek is improving the varieties of sunflowers, which are extensively grown as a crop in Southern Russia.

In Moscow, the Institute of Experimental Biology is one of several laboratories under the direction of Professor Koltzoff, in which a great range of genetical and cytological as well as other experimental work in animal biology is being done. The genetical section is in charge of Professor Tschetverikoff. Much eugenical work is also being done in Moscow and in Leningrad, especially in the collection of pedigrees, and a Russian *Journal of Eugenics* is edited by Professors Koltzoff, Liublinsky and Philiptschenko. The Timiriazev Institute in Moscow, under the direction of Professor Navashin, is chiefly devoted to research in plant cytology and genetics. Professor Gates also visited the Botanical Gardens in Leningrad, Tiflis and Batoum, the chief interest of the Tiflis garden being its large collection of Caucasus plants. A study was made of the tundra vegetation in the far north and the steppe region in Southern Russia and the Caucasus. While in Moscow Professor Gates was present at the opening of a small museum of Metchnikoff relics in the Institute of Experimental Pathology. Madame Metchnikoff came from Paris for the occasion.

PAUL KAMMERER'S LETTER TO THE MOSCOW ACADEMY

The following letter was sent to the officials of the Moscow Academy of Science by Dr. Paul Kammerer, professor of biology in Moscow University, a few days before his death.

Vienna, September 22, 1926.

To the Presidium of the Communist Academy, Moscow.
Respected Comrades and Colleagues:

Presumably you all know about the attack upon me

made by Dr. Noble in *Nature*, of August 7, 1926. The attack is based upon an investigation of the exhibits of alytes (toads), with heat stripes, proving my theory, made by Dr. Noble with Professor Przibrams in the Vienna Biological Experimental Institute and with my permission.

The principal matter of importance in this is an artificial coloring, probably with India ink, through which the black coloring of the skin in the region carrying the stripes is said to have been faked. Therefore it would be a matter of deception that presumably will be laid to me only.

After having read the attack I went to the Biological Experimental Institute for the purpose of looking over the object in question. I found the statements of Dr. Noble completely verified. Indeed, there were still other objects (blackened salamanders) upon which my results had plainly been "improved" post mortem with India ink. Who besides myself had any interest in perpetrating such falsifications can only be very dimly suspected. But it is certain that practically my whole life's work is placed in doubt by it.

On the basis of this state of affairs I dare not, although I myself have no part in these falsifications of my proof specimens, any longer consider myself the proper man to accept your call. I see that I am also not in a position to endure this wrecking of my life's work, and I hope that I shall gather together enough courage and strength to put an end of my wrecked life to-morrow.

I am not stopping the packing up of the things destined to be taken with me. First, because it would attract the attention of my family, which must not know anything of my intention before it is carried out; and, second, because I am thus making my last will and testament giving my library into the care of the Communist Academy in Moscow, so that this will compensate it for all the efforts it has wasted upon me.

Finally, I ask that my heartiest farewell greetings be given to the following friends: . . .

With the plea that you will forgive me for having made you all this trouble, I am,

Yours devotedly,
Paul Kammerer

THE NEW BUFFALO MUSEUM OF SCIENCE

The corner-stone of the new Buffalo Museum of Science, to be erected in Humboldt Park, was laid on the afternoon of October 16. The new museum building will be a four-story structure costing approximately $1,000,000. According to *Museum News* authorization for its construction was submitted to the people of Buffalo by referendum in 1923 and was carried by a large majority. The structure is to be built and equipped by the city for occupancy by the Buffalo Society of Natural Sciences. For some years past the society has had two temporary museum premises—one downtown in the building of the Buffalo Public Library and one on Elmwood Avenue. Both of these quarters are soon to be given up for the new home now under construction.

While no radical departures have been made in planning the arrangement of the new building, much study has been given to its various problems, with the result that it embodies noteworthy features. The ground floor will be utilized for children's work and the visual education and photographic departments. The main floor will be devoted to systematic exhibits and the second and third floors will be utilized for the purposes of research in its broadest sense, including the storage of reserve and other collections. The offices, both administrative and scientific, are planned to be readily accessible to the public from the main entrance. Library, class rooms, laboratories and storage vaults have also been so located that the work of the museum may progress in the most effective manner.

In addition to the main library there will be a children's library. A special space will be set apart for a biological research and pedagogic laboratory, which will have at least a dozen aquaria in addition to its other equipment. Disinfecting rooms and many other improvements are also provided for in the plan of the new structure.

The preparation of exhibits for the new museum is going forward while the building is under construction. An experimental room has been arranged at the old quarters in the Public Library building, and there, with the use of a one-room equipment of standard cases, installations are being made in succession. As each exhibit is finished, notes are taken and the entire lot of material is then packed away to await final housing in the new museum. This plan will reduce to the minimum the time which must elapse between the completion of the building and its opening to the public.

PLANT CONGRESS PHOTOGRAPHS

An exceptionally fine and complete set of photographs was obtained of those who attended the International Congress of Plant Sciences held at Cornell University this past summer. Some early requests from libraries and individuals for complete sets of these group photographs suggested the desirability of a bound volume of these photographs as a permanent record for libraries, museums or individuals interested in this first great gathering of representatives of all plant sciences. I have arranged with the university photographer who was the official photographer for the congress to prepare such complete bound sets for those who may wish to order them.

The volume will contain thirteen pictures of groups representing different sections of the congress, including also a group picture of the officers and about

twenty individual photographs of some of the prominent delegates. There will also be a panoramic view of the university campus, with pictures of the buildings in which the activities of the congress especially centered. All group and individual pictures will be mounted on cloth, with complete printed keys facing the photograph. They will be neatly and substantially bound in a volume for the library shelf.

Those desiring to obtain such a volume should communicate immediately with J. P. Troy, photographer, Sibley College, Ithaca, N. Y., who will also supply single group pictures with printed keys.

H. H. WHETZEL,
Chairman, Local Arrangements

CORNELL UNIVERSITY,
ITHACA, N. Y.

THE DINNER TO PROFESSOR L. R. JONES

DURING the meetings of the International Congress of Plant Sciences at Ithaca a dinner was held in honor of Professor L. R. Jones, of the University of Wisconsin, as already recorded in SCIENCE. Further particulars of the occasion have been received. In token of their appreciation his friends and former students presented an oil painting of Professor Jones to the University of Wisconsin, and a set of 29 volumes of their collected works of the period 1910–1926 to Professor Jones.

The after-dinner program was presided over by W. A. Orton, who pointed to the fact that service had been the ruling factor in the life of Professor Jones. He then called on A. G. Johnson to respond to the toast "The Teacher"; L. H. Bailey, "Contributions to Agricultural Education"; I. E. Melhus, "The Investigator"; H. A. Edson, "Development of a Graduate School in Plant Pathology"; R. A. Harper, "Leadership in Biology and Agriculture"; and Erwin F. Smith, "The Man." The portrait was then presented by W. A. Orton and accepted on behalf of the University of Wisconsin by G. W. Keitt. Dr. Otto Appel, of Berlin, Germany, and Dr. E. J. Butler, of Kew, England, spoke in appreciation of Professor Jones and of his influence abroad. In expressing his appreciation Professor Jones warned against the danger of professionalism, and stressed the point that we go forth holding honorary fellowships for service to society through plant science.

SCIENTIFIC NOTES AND NEWS

ACCORDING to an Associated Press dispatch, the Nobel prize for chemistry for 1925 has been awarded to Dr. Richard Zsigmondy, professor of inorganic chemistry at Göttingen University, and for 1926 to Professor Theodore Svedberg, of the University of Upsala, Sweden. The prize for physics for 1925 has been divided between Professor James Franck, University of Göttingen, and Professor Gustav Hertz, of Halle, and the 1926 award has been made to Professor Jean Baptiste Perrin, of the Sorbonne, University of Paris.

OFFICERS for the coming year were elected by the American Ornithologists Union at its forty-fourth meeting held at the Victoria Memorial Museum, Ottawa, as follows: *President,* Dr. Alexander Wetmore, assistant secretary Smithsonian Institution; *vice-president,* Dr. Joseph Grinnell, Museum of Vertebrate Zoology, University of California; *second vice-president,* Mr. J. H. Fleming, Toronto; *secretary,* Dr. T. S. Palmer, Biological Survey, Washington, D. C.; *treasurer,* Mr. W. L. McAtee, Biological Survey, Washington, D. C.

DR. FRED B. LUND, of Boston, has been appointed director of the Gorgas Memorial Institute.

PROFESSOR W. W. PAYNE, who established the Elgin Observatory for the Elgin National Watch Company in 1910 and who has directed the work of this observatory since that time, has been made director emeritus. Mr. Frank D. Urie, who has been a member of the observatory for several years, has been appointed director.

PROFESSOR LOUIS BAUER, of the Carnegie Institution of Washington, has been elected a member of the executive committee of the International Society for studying the Arctic Regions, which has been holding its first congress in Berlin.

DR. ADOLF MEYER, director of the Henry Phipps Psychiatric Clinic, the Johns Hopkins Hospital, has been elected president of the Mental Hygiene Society of Maryland, to succeed Dr. Edward N. Brush.

DR. CHARLES HENRY MORSE, professor of obstetrics and gynecology at the Yale University Medical School, has been elected an honorary member of Tufts University chapter of Phi Beta Kappa.

A PORTRAIT of Dr. John B. Shapleigh was unveiled, November 10, at the Washington University School of Medicine, St. Louis. Dr. Shapleigh for many years was professor of otology and for one year was dean of the faculty.

DR. ALEXANDER TSCHIRCH, professor of pharmacology at the University of Berne, recently celebrated his seventieth birthday.

DR. C. WILLEMS, professor of surgery, University of Liège, has been made a commander of the order of the Crown of Italy.

R. W. Goranson, of Harvard University, and S. B. Hendricks, of the California Institute, have joined the staff of the Geophysical Laboratory, Carnegie Institution of Washington.

Axel Oxholm, director of the National Committee on Wood Utilization, which has its headquarters in the U. S. Department of Commerce and works in conjunction with the department, has announced the appointment of A. B. Cone, of Chicago, as director of the research activities of the committee.

A. H. Low, professor of chemistry at the Colorado School of Mines, has resigned to take up research work in Denver, Colorado.

Harold J. Barrett has resigned as assistant professor of organic chemistry at South Dakota State College, Brookings, to take a position in the Experimental Station of E. I. du Pont de Nemours & Co., Wilmington, Del.

Dr. Cecil K. Drinker, professor of applied physiology and assistant dean of the School of Public Health and Hygiene of the Harvard Medical School, has been granted a year's leave of absence. He has gone to Copenhagen to work with Dr. Krogh.

Dr. Alfred N. Richards, professor of pharmacology at the University of Pennsylvania Medical School, has been granted leave of absence for a year for the purpose of study and travel abroad. He is at present working at the National Institute for Medical Research in London.

Dr. Alfred Chanutin, assistant professor of biochemistry in the medical department of the University of Virginia, has been given leave of absence for research work with Professor Ross at the University of Illinois.

Dr. L. W. Austin, head of the U. S. Naval Research Laboratory in the Bureau of Standards, is now on his way to Japan, representing the United States Government and the International Union of Scientific Radio Telegraphy. He plans to stop for several weeks at Honolulu, where he will undertake special static observations in that part of the Pacific, and is expected to return to this country before the first of the year.

Dr. Johannes Walther, of Halle, Speyer visiting professor at the Johns Hopkins University, will arrive in this country early in February. He will give courses on denudation in arid climates and on paleontology and earth history.

Dr. William Montgomery McGovern has arrived in the United States after having spent nearly two years in South America exploring the region of the Amazon, under the auspices of the British Museum of Natural History.

Dr. Richard Whiddington, Cavendish professor of physics at the University of Leeds, lectured on "The Luminous Discharge of Electricity through Rare Gases" at Cornell University on November 11. The lecture was given under the auspices of the Jacob H. Schiff Foundation.

Dr. E. Schrödinger, professor of theoretical physics in the University of Zürich, will be in residence at the University of Wisconsin for four weeks, beginning on January 6. He will deliver a course of lectures in the department of physics on the general subject of "Recent Developments in Quantum Mechanics."

Professor Broensted, University of Copenhagen, will give two public lectures at the University of Chicago in February on special topics of physical chemistry of interest to physicists, chemists and biologists.

The Franklin Institute was addressed on November 11 by Dr. Howard T. Barnes, professor of physics at McGill University, who spoke on "Thermit and Icebergs," and on November 17 by Dr. Richard C. Tolman, professor of physical chemistry and mathematical physics at the California Institute of Technology, on "Statistical Mechanics and its Application to Physical-chemical Problems."

Dr. W. Mansfield Clark, chief of the division of chemistry of the U. S. Public Health Service, gave a lecture on November 3 on "A New Approach to the Study of Oxidation-reduction in the Living Cell," before the University of Wisconsin chapter of Sigma Xi.

Dr. Albert Mann, research associate in biology at the Carnegie Institution of Washington, gave an illustrated lecture at the institution on November 16, entitled, "Diatoms: What they are and what they do."

Dr. W. E. Ruder, of the General Electric Company, Schenectady, gave a talk to the staff and advanced students of physics in Amherst College, on November 5. His subject dealt with the making of large crystals.

Professor W. G. Cady, of the department of physics at Wesleyan University, recently addressed the staff and advanced students in the department of physics of Amherst College on "Vibrating Crystals."

Dr. George E. de Schweinitz, of Philadelphia, was the principal speaker at a dinner held in Boston, on November 4, in celebration of the centennial of the Massachusetts Eye and Ear Infirmary.

The 1926 Robert Kennedy Duncan memorial lecture was delivered by Lawrence V. Redman, director

of research of the Bakelite Corporation, in the fellows' room of the Mellon Institute of Industrial Research, University of Pittsburgh, on November 1 (Dr. Duncan's birthday). On November 2, Mr. Redman again addressed the members of the institute, speaking on "Why Chemists should be Financiers."

The Norman Lockyer lecture for 1926 will be given on November 23 by Dr. J. S. Huxley, professor of zoology and animal biology at King's College, on the subject of biology and human life.

Edwin A. Hartley, professor of entomology in Syracuse University, died on October 15, aged thirty-three years.

Dr. Edward C. Briggs, emeritus professor of materia medica and therapeutics at the Harvard Dental School, died on November 7, aged seventy years.

The Reverend Francis David Morice, of England, well known as an authority on certain families of Hymenoptera, died on September 23 in his seventy-eighth year.

Dr. A. R. Rowe, known for his work on the English chalk strata, died on September 17, aged seventy-eight years.

Dr. Theodor Des Coudres, professor of theoretical physics at the University of Leipzig, has died at the age of sixty-four years.

Tasushi Nawa, a Japanese entomologist, known for his work on white ants, died recently at the age of seventy years.

The death of Professor Ermanno Giglio-Tos, professor of zoology in the University of Turin, occurred recently.

On Thursday evenings beginning on October 7 a series of four radio lectures on chemistry were broadcast from Station WMAQ by members of the University of Chicago staff. The lecturers and their subjects were: Professor Schlesinger, "Chemistry in the Service of Peace"; Professor Harkins, "The Transformation of Elements, its Possibilities and its Limitations"; Professor Stieglitz, "Chemistry and Health"; Dr. W. Lee Lewis, director of research, The Institute of American Meat Packers, on "The Industries of the Chicago District."

The twenty-eighth annual meeting (the 142nd regular meeting) of the American Physical Society will be held in Philadelphia from December 28 to 30, in affiliation with section B—physics—of the American Association for the Advancement of Science. At the session in charge of section B, on Tuesday afternoon, December 28, Professor H. M. Randall, the retiring vice-president and chairman of section B, will give the annual address on "Infra-Red Spectroscopy." This will be followed by an address by Professor W. F. G. Swann, of Yale University, on "The New Quantum Dynamics." There will be an informal subscription dinner for the members of the society and section B and their friends on Wednesday evening.

The Association of Professional Astronomers will meet in New Haven early in December, according to an announcement made by the Yale Observatory, where the meeting will be held. The organization was founded in 1921 under the auspices of the university observatory and its director, Dr. Frank Schlesinger.

The third Pan-Pacific Science Congress, which was attended by leading scientists of all the Pacific nations, closed its ten-day session by organizing a permanent Pacific Science Association "To initiate and promote cooperation in study of the scientific problems relating to the Pacific, particularly those affecting the prosperity and welfare of the Pacific peoples and to strengthen the bond of peace among the Pacific peoples by promoting a feeling of brotherhood among their scientists." The next meeting will be held in Java.

A special state appropriation of $25,000 per annum for 1926 and 1927 has been granted to the Experiment Station at the University of Louisiana for special investigations in sugar cane problems.

The amount raised by the American Society for the Control of Cancer toward its $1,000,000 educational fund has reached a total of $452,597.

A scholarship in mining and metallurgical engineering, with a value of $500 a year, is being offered by the Woman's Auxiliary of the American Institute of Mining and Metallurgical Engineers. The scholarship, for which application must be made before the end of November, is renewable yearly until graduation. The beneficiary, as his means permit after graduation, will be expected to repay at least 50 per cent. of the scholarship advanced to him, such repayments to be added to the general fund.

The Hatch collection of fossils, petrifications and minerals which formed part of the exhibit of the mines and mineralogy section of the Centennial Exposition in 1876, has been presented to the University of Pennsylvania, following its purchase by George E. Nitzsche, recorder of the university. The collection contains several thousand specimens and is especially rich in fossil stones.

The library of the late Professor Klein, of Göttingen, which was purchased for the Institute of Mathematics of the Hebrew University, is now ready for use. This library contains about 3,500 volumes

on mathematics and is particularly rich in complete sets of all important mathematical journals.

THE International Institute of Agriculture announces that the proceedings of the World Forestry Congress at Rome, April 29 to May 5, 1926, will be published by it before the end of the present year. The proceedings will include some three hundred reports submitted to the congress, of which about one fourth are in English, and will form five octavo volumes of about 3,500 pages.

THE seventh field conference under the direction of the Oklahoma Geological Survey was held in the Ouachita Mountains of southeastern Oklahoma, beginning October 11, and continuing six days. Nineteen men attended, including geologists from Oklahoma, Texas, Louisiana and Washington, D. C. Studies were made of the lower Paleozoics and of the Mississippian and Pennsylvanian formations of the Ouachita Mountains. The eighth field conference will be held in November in western Oklahoma, the Panhandle of Texas and northeastern New Mexico. The object of the conference will be to study the outcrops of the Permian beds on the east and west sides of the High Plains basin, and to attempt to find some key bed which will serve for correlation purposes.

THE United States Coast and Geodetic Survey has begun work on the complete offshore surveys of the gulf coast. The survey ship, *Bache,* under the command of Lieutenant R. L. Schopps, is off the coast of Florida, engaged in mapping work. The gulf coast for approximately 15 miles east of the Pensacola Entrance was resurveyed in 1920 and 1922, and complete coast charts for that section prepared. Eastward of that limit the present charts are based on surveys made just before, and immediately after, the war of 1861, with the exception of recent work in some of the bays and entrances. The present survey will begin at meridian 87, about 15 miles east of Pensacola Entrance, and will be carried out to a depth of 100 fathoms and as close inshore as survey launches can work.

THE newly-created Society of British Foresters held its inaugural meeting during the recent meeting of the British Association at Oxford. According to *Nature,* the object of this society is to help in the technical development of forestry in Great Britain. Forestry is coming more and more into prominence, and it is felt that the time has arrived for the establishment of an association of those engaged in it and in allied sciences. A journal will be published, and this will provide a place for the publication of the results of forestry investigation and practice in Great Britain, and for the dissemination of results obtained elsewhere. The officers of the society are: *President,* Mr. R. L. Robinson; *vice-president,* Professor R. S. Troup; *members of council,* Mr. C. O. Hanson, Major F. M. Oliphant, Mr. R. S. Pearson, Mr. Frank Scott, Mr. J. D. Sutherland, Dr. Malcolm Wilson; *editor of journal,* Dr. H. M. Steven; *business editor,* Mr. J. Lyford Pike; *secretary and treasurer,* Mr. R. Angus Galloway.

UNIVERSITY AND EDUCATIONAL NOTES

IN the state election of November 2, the citizens of California, by an approximately 3 to 1 vote, authorized an immediate bond issue, in amount $6,000,000, to provide academic buildings on the new campus of the Southern Branch of the University of California at Los Angeles, and for permanent buildings on the campus of the university in Berkeley, to replace temporary wooden buildings.

LEHIGH UNIVERSITY has announced plans for the erection of a new electrical and mechanical engineering laboratory, which will be the largest building on the campus and will cost about $1,000,000. In addition to laboratories it will include an auditorium seating 500, a museum for the display of apparatus and data pertinent to instruction in engineering and an engineering library.

THE Italian government has granted 20,000,000 lire to the University of Rome for repairs and new construction work. The plans contemplate the creation of a university city comprising three groups of edifices, one devoted to medical study, the second to scientific and the third to include the faculties of law, letters and political science. A residential hall for 800 students and a large athletic field also will be built.

DR. GEORGE D. OLDS has asked to be relieved of his duties as president of Amherst College at such time as a successor can be appointed. Dr. Olds was formerly dean of the college and professor of mathematics.

AT the University of Illinois, Professor Roger Adams has been appointed head of the department of chemistry to succeed Professor W. A. Noyes, who was retired under the new retirement provision. Dr. Donald B. Keyes, director of research and development of the United States Industrial Alcohol Company, succeeds Professor S. W. Parr as professor of industrial chemistry.

DRS. G. H. WOOLLETT and V. A. Coulter have been advanced to the rank of professor in the department of chemistry of the University of Mississippi. Dr.

H. F. Johnstone, Ph.D. (Iowa, '26), has been appointed assistant professor in the same department.

AT the Rice Institute, A. C. Chandler, Ph.D. (California), head of the department of helminthology at the Calcutta School of Tropical Medicine, has been elected professor of biology; Szolen Mandelbrojt, D.Sc. (Paris), has been appointed to a lectureship in mathematics, and C. F. Arrowood, Ph.D. (Chicago), A. D. Garrison, Ph.D. (Rice), and L. B. Ryon, C.E. (Lehigh), have been promoted to assistant professorships in education, physical chemistry and civil engineering, respectively.

IN the school of medicine at the University of Texas, Dr. Henry C. Hartman began his work as dean at the opening of the fall term. Dr. Charles T. Stone, after a year's study abroad, has taken up the professorship of medicine. Dr. Titus H. Harris will be in charge of the new department of mental and nervous diseases. Dr. John K. Glen becomes professor of anatomy, Dr. Meyer Bodansky, associate professor of biological chemistry and Dr. Paul Brindley, adjunct professor in pathology.

AMONG the deans of faculties elected by the University of London for the period 1926–28 are the following: Medicine, Sir Cuthbert Wallace (St. Thomas's Hospital Medical School); science, Professor L. N. G. Filon (University College); engineering, Professor E. H. Lamb (East London College).

DR. MAURICE ROCH, professor of clinical medicine, has been appointed dean of the medical faculty at Geneva.

PROFESSOR TRENDELENBURG, of Freiburg, has received a call to the chair of pharmacology at the University of Berlin as the successor to Professor Heffter.

DISCUSSION AND CORRESPONDENCE

MIGRATION OF BONITOS OR VICTOR-FISH IN THE NORTH PACIFIC

THE most abundant fish in the open waters of the Pacific is the oceanic bonito, *Katsowonus vagans*. This is known to the Japanese as Katsuwo or Victor fish and in Hawaii as the aku. It is a mackerel-like fish, ranging in length to about three feet, and its red flesh is now very extensively canned as "tuna" along with other fishes of similar character.

I learned in Honolulu, on good authority, that a school of these fishes ninety-six miles in length had once been noticed passing Hawaii. I had occasion to discuss this with a business man who frequently went from San Francisco to Hawaii, Mr. A. C. Lovekin, and he gave me a similar account of an experience of his own. I am sending this for publication, for I am sure that the matter is one of interest to many naturalists. With the Victor fish which Mr. Lovekin calls Bonito there were a considerable number of tuna (Thunnus) and other large fishes and they were easily caught with improvised harpoons. In Honolulu the aku is generally obtained by securing numbers of small fishes, particularly anchovies and throwing them into the water. The aku pick them up. They are then taken on a hook and cut into pieces to be used as bait for tuna and other large fishes.

DAVID STARR JORDAN

STANFORD UNIVERSITY

DURING the months of July and August, 1893, I made a voyage from Honolulu to San Francisco on the bark "Andrew Welch," Captain Drew, and observed what to me was an interesting thing in the life of two of our North Pacific fishes.

It was a period of light winds and our ship was drifting with a headway of but a few knots an hour some hundreds of miles almost due north of Hawaii and about in the latitude of San Francisco. Upon coming on deck one morning we found that we were surrounded by a school of tuna and bonitos.

There seemed to be no limit to their number and far as we could see on all sides the ocean was packed with fish. I observed them for the ten or more days that they accompanied us, noting that they appeared to have arranged themselves in uniform ranks in swimming and kept their individual position continuously, adopting our vessel as guardian and guide, always following the same course as taken by the ship. They apparently were not feeding, although I caught many of the smaller bonito using a bit of white rag attached to a common fishhook and harpooned and landed a few of the larger tuna, some of which weighed up to eighty pounds.

Captain Drew, who had been in the sailing vessel service between San Francisco and Hawaii for over twenty years, assured me that he had not observed a similar migration on any of his former voyages and all the sailors on board assured me it was the first time they had seen anything of the kind.

The school accompanied the ship for some ten or more days and it was only after a strong breeze had given our vessel good headway that we finally parted company with our finny friends.

A. C. LOVEKIN

RIVERSIDE, CALIFORNIA

BOVERI ON CANCER

THE article in SCIENCE for October 1 on "The Present State of Scientific Knowledge of Cancer" is illuminating as to the state of ignorance by physicians of the nature of cancer. Boveri's studies of

double fertilized sea-urchin eggs established the probability that human and other animal cancer is essentially a distortion of the numerical relations of the chromosomes in the cells. But, so far as I have been able to learn by extensive inquiry extending over fifteen years, no American physician knows of these most fundamental studies ever made upon cancer. A realization of the nature of the disease seems a natural prerequisite to the most worthy study of its causes and cure.

To be sure, few physicians are trained cytologists, but there must be some who are sufficiently trained to read Boveri's papers with understanding. Probably also no American physician has the cytological skill to continue Boveri's studies, but if the directors of cancer research were informed as to the foundation Boveri has laid for an understanding of this disease they might be able to secure aid from cytologists competent for this work, though this would by no means be easy. The technique in this most intimate field is forbiddingly difficult. But, however difficult further research may be, there is no adequate excuse for ignorance of this the most illuminating work ever done upon cancer. No one can study the subject intelligently unless fully cognizant of Boveri's studies.

MAYNARD M. METCALF
JOHNS HOPKINS UNIVERSITY

A PERIDERMIUM NEW TO THE NORTH-EASTERN UNITED STATES

DURING the first week of June, 1925, the writer discovered a gall-forming Peridermium on *Pinus sylvestris,* Scotch pine, bordering Round Lake near Woodgate, New York.

The Scotch pine is in plantations which were established by a Mr. R. Dallarmi, a Bavarian, who acquired the land in 1856. He cleared most of the ground, which had been lumbered and devastated by fire for the growing of farm crops. The topography of the land is gently rolling and the soil is a very light sandy loam. Some of the ridges and knolls are almost pure sand, and when they became too poor for farming they were reforested by the broadcasting of seed of *Pinus sylvestris, Pinus strobus* and *Picea excelsa. Pinus sylvestris,* with one or two exceptions, predominates. It is the only species present in some of the plantations.

Mr. Dallarmi imported the seed from Germany. Small plantings of seedlings of *Pinus sylvestris, P. Austriaca, P. strobus,* and *Picea excelsa* which he grew from seed were made around the home grounds and a small cemetery in 1870. Plantations were established by sowings of seed in '74, '79, '80 and '83. He kept careful records of all the crops and there seems to be no mention of any seedling forest trees other than the ones which he grew from seeds being planted on his estate. A daughter, Miss Mary W. Dallarmi, and former neighbors who knew Mr. Dallarmi for many years prior to his death in 1913, claim that no trees from any outside source were brought to his farm. The source of the infection at Woodgate is as yet entirely unknown.

In June and August of 1925, the writer made careful searches for alternate hosts of the Peridermium, but none were found. Very thorough scoutings have been made the present season by various workers for such plants. To date, October 4, 1926, no uredinial and telial stages have been discovered. This Peridermium is undoubtedly autoecious at Woodgate, N. Y.

The galls of this Peridermium are quite similar in shape to those of *Cronartium cerebrum* (Peck) Hedgc. and Long. But the aecia of the Woodgate peridermium are not cerebroid. Furthermore, there are no oaks, the alternate hosts of *C. cerebrum,* within ten miles of Woodgate. There is a striking resemblance between the galls of the Peridermium occurring at Woodgate and the illustrations of *Peridermium giganteum* (Mayr) Tub. which occurs on *Pinus densiflora* in Japan, but this rust is apparently heteroecious.

It is not known whether the Woodgate Peridermium will attack other hard pines. With the exception of probably a dozen *Pinus austriaca* and a few hundred *Pinus resinosa* which have been planted in recent years, there are no other hard pines in the Woodgate region. As yet the *Pinus austriaca* and *P. resinosa* do not seem to be attacked by the Peridermium. There are about fifteen acres reforested on the Dallarmi estate, which is now owned by the Masonic Lodge of New York. Natural seeding of *Pinus sylvestris* has resulted quite freely, the trees ranging from one to twenty or more years of age. The Peridermium is distributed throughout the planted and natural seeded areas. It is also known to have spread into plantations of *Pinus sylvestris,* one hundred and ten miles distant from the Round Lake infection.

The Conservation Commission and the Office of Forest Pathology in the U. S. Department of Agriculture are cooperating on an intensive study of the Peridermium at Woodgate. Some of the results of this work to date are: This Peridermium has been at Woodgate for at least thirty years. The amount of infection has increased rather rapidly since 1920. Infection apparently takes place on the current season's wood and through the epidermis of the twigs and stems. Infections may occur on the axis where the staminate cones are borne. In 1926 the aecia began to appear about the middle of May. The climax of aecia production occurred the first week in June. Viable spores were found in a canker August 21, 1926. In the majority of cases the cankers bear their

first aecia the third season following infection. Some galls fruit when only two years old.

Harlan H. York
Conservation Commission,
Albany, N. Y.

A NEW BIBLIOGRAPHY OF SCIENTIFIC JOURNALS

A large number of the principal libraries in the United States and Canada are now cooperating in the compilation of a check list of periodical literature which will be of great value to all workers in science. It will not be limited to scientific literature but will include practically all serials of a scientific nature that are held by one or more of the cooperating libraries. No classification is attempted. The list gives the full name of each serial (including academy publications), the places and dates of publication, variations in titles and an exact statement of the holdings of each cooperating library. For such workers as enjoy the privileges of a library which enters into the inter-library loan arrangement, this new list will provide access to practically every journal or society publication which has reached America. Others will be informed of the nearest library at which the desired reference may be consulted.

The new work will be called the Union List of Serials and will be published by the H. W. Wilson Company of New York. The Provisional Edition from A to R is now available in sections and the Final Edition, a volume of about twenty-five hundred pages and seventy-five thousand entries, will be ready late in 1927.

Charles J. Lyon
Dartmouth College

SCIENTIFIC BOOKS

Brains of Rats and Men. A Survey of the Origin and Biological Significance of the Cerebral Cortex. By C. Judson Herrick. xiii + 382 pp., 53 figs. Univ. of Chicago Press, 1926.

In the first eight chapters of "Brains of Rats and Men" the author lays the anatomical foundation for his discussion of the learning processes of rats and men which constitutes the latter part of the book.

The practically unlimited potentialities of diversity of cortical association combinations are argued mathematically upon anatomical data (Chapter I), and are regarded "adequate for any theoretic explanation of cerebral functions whatever." The author then shows (Chapter II) how there has been worked out in the cerebral cortex a mechanism of maximum efficiency adequate for the analysis of many afferent systems of different kinds and their regrouping through a wide range of different pathways, a type of organization that is in strong contrast with the mass reflexes of the spinal cord and corpus striatum. The problem of the conditional reflex (Chapter III) is approached through an illustration of the neural mechanism of lower vertebrates, particularly fishes and amphibians, in relation to the behavior pattern. In a similar manner the evolution of the cerebral cortex (Chapter IV) is traced through the ichthysiopsid (fishes and amphibians), sauropsid (reptiles and birds), mammalian and human types, and the genetic, structural and physiological interrelations of the cerebral cortex and the corpus striatum is analyzed for birds and reptiles (Chapter V), and for mammals (Chapter VI). The phylogenetic development of the thalamus is then comparatively treated through the ichthysiopsid, sauropsid and human types, and the phylogenetic age of the thalamus (Chapter VII) is emphasized as a basis for appreciation of its bearing on physiological and psychological problems. In illustration of these relations a series of new diagrams (page 31) is introduced with good effect. In the treatment of the cerebral hemispheres (Chapter VIII) the marsupial brain as described morphologically by Obenchain, histologically by Gray and physiologically by Gray and Turner, is given large place, and somewhat similar studies of the brain of the rat by Furtuyn, Craigie, Sugita and Lashley are taken as the immediate approach to the discussion which comprises the latter part of the book.

In an effort to arrive at a true interpretation of "how rats learn" (Chapter IX) the author discusses, upon the basis chiefly of Lashley's work, the questions of strictly subcortical processes, special structures for facilitation of learning, short-circuiting of habit formation processes from cortical to subcortical mechanisms, disturbance of learned processes by cortical injury, interrelation of the amount of cortex functioning and the rate of learning, localization of cortical functions, equipotentiality, the relation of cortex to corpus striatum in the habit-learning process, and the unique rôle of the frontal cortex. Certain phases of this discussion are elaborated in detail (Chapters X to XIII), under the topics "Mechanisms of Learning in the Rat," "Localization of Learned Processes in the Cerebral Cortex of the Rat," "The Frontal Lobes" and "Association Centers." These topics are then reviewed (Chapter XIV) as a "Summary of Cortical Evolution." In his treatment of the "Subconscious" (Chapter XV) the author presents the cerebral cortex as an organ of creative automaticity that has designed and fabricated itself during its ontogenetic and phylogenetic development, and the working of which is intelligence. He insists that appeal to the "metaphysical, theological, mythologi-

cal, or other unscientific prejudices" can be escaped only by accepting consciousness as a function of the brain in the sense of a vital mode (Chapter XVI) like muscle contraction, nerve conduction or reflex physiological habit, and, therefore, as a causative factor in bodily activity. Allied with this vital function are systems of "vital reserves" (Chapter XVII) ranging from the simple reflexes to the more general reserves of the cerebellum and the specific mnemonic reserves of the cerebral cortex, the last of which is the source particularly of spontaneity, initiative and inventiveness. "Forward Reference" (Chapter XVIII) through symbolism "comes to fruition as conscious purpose," which is not a mystical force but the natural result of cortical processes which are natural results of previous bodily activities—the expression of vital reserves in cortical action.

The last chapter (XIX), which can not be briefly summarized but must be read in the light of what goes before in order to be fully appreciated, urges the consideration that man's behavior is not that of rats and monkeys simply enlarged and complicated, but contains new patterns not elsewhere known, in which habitude "gives way to insight in terms of generalization of experience, foresight of possible future consequences of action, the fabrication of consciously directed purposes, deliberative choice in view of these purposes, and finally the development of ideals of character and the shaping of daily conduct with a view to molding the personality in conformity with these ideals." Since "mind as cause" is in this unique pattern a "new vital mode" it is purely biologic. At the same time it pragmatically satisfies all requirements "esthetically, socially, morally."

In the preface Professor Herrick explains that this book is the outgrowth of a resurvey of the cerebral cortex, particularly in the light of "Lashley's fundamental experiments in the learning processes of rats," in search for a "common ground upon which objective psychology and introspective psychology may cooperate harmoniously without sacrifice of sound scientific method or of those distinct technical procedures which each of these sciences has hitherto so fruitfully employed." In line with this purpose the work appeals to the writer as an exceedingly valuable contribution, in which masterful, detailed knowledge of the nervous system blends with a comprehensive view of the field of psychology. Since the details of conduction paths are not introduced, profitable reading requires only a good knowledge of the general divisions of the brain and of cortical structure.

The personal touch given by the author's reference to his brother, the late Professor Clarence Luther Herrick, as his inspiration to scientific endeavor in the particular line of this work will meet an affectionate response on the part of all who knew that "unsurpassed teacher" as companion and friend.

G. E. COGHILL

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A SIMPLE METHOD FOR THE DEVOCALIZATION OF DOGS

IN a laboratory situated within a residential district, it is frequently somewhat of a problem to keep a number of experimental dogs because of their persistent barking during their cage confinement. Training the animals to remain quiet requires a great deal of time and much more patience and is usually unsuccessful. If new dogs are being continually introduced into the laboratory it is impossible to prevent this annoyance except by depriving the dogs of their vocal function. The following method of devocalization is recommended for its simplicity and effectiveness. In the past year successful devocalization has been accomplished on over one hundred dogs at the School of Hygiene and at the Biological Laboratory at Cold Spring Harbor, L. I., N. Y.

A head-holding device, as is illustrated in Fig. 1, is very inexpensive and is adaptable to almost any type of operating table. It is necessary to employ some such mechanism as this, as it is exceedingly difficult to procure a mouth-gag that is suitable for all sizes and types of dog mouths.

This apparatus was devised and built in the laboratory. The support (A) is of strap iron $1\frac{1}{4}'' \times \frac{3}{8}''$ bent as illustrated to conform to the dimensions of the table and the general proportions indicated in the figure. The horizontal portion is drilled ($\frac{1}{4}''$ holes) about two inches from each end (D and D′) to accommodate two ring-bolts. If rope-holding clamps are available, they may be fastened to the support in place of the ring-bolts. The vertical portions of the support are drilled ($\frac{1}{4}''$ holes) at several three-inch intervals from the free ends, so that the height of the rack may be adjusted to the requirements of the animal. Small stove-bolts through a pair of these holes at corresponding levels hold the rack at the desired height. The ends of the support penetrate pieces of strap iron $3\frac{1}{2}'' \times 1\frac{1}{4}'' \times \frac{1}{8}''$, which are provided with slots to receive the ends of the support. Two holes are drilled in each of these plates to take the wood-screws or bolts which fasten them to the top of the table flush with the surface. The rack is further secured by two pieces of strap iron $3\frac{1}{2}'' \times 1\frac{1}{4}'' \times \frac{1}{8}''$, sufficiently offset to embrace each end of the support. These are fastened to the table by bolts, as

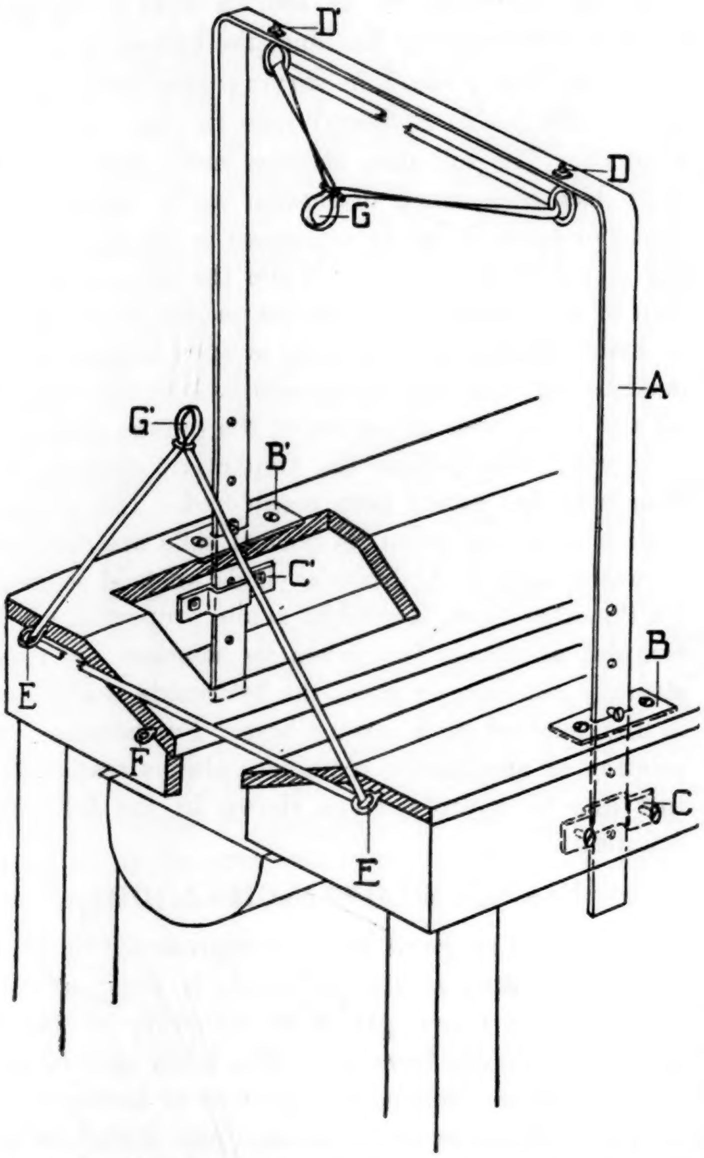

FIG. 1. Diagrammatic representation of front end of operating table with head-holding rack in position. Section on left side cut out to show details of fastening support at C'.

shown in the illustration.

The rack may be removed when not in use. It should be protected against rust either by galvanization before assembling or by painting with aluminum paint.

The front end of the table is provided with two large screw-eyes (E and E′) and one smaller one (F).

For holding the jaws, lamp wicking three fourth inch wide has been very satisfactory. A narrow brass buckle slipped close to the dog's muzzle holds the wicking tightly around his jaw. The wicking has the advantages of being soft and flat enough to protect the dog's lips, and yet of gripping the jaws of any size dog very securely.

The dog is prepared for the operation by the injection of about 1/150 grain of atropin sulphate (in order to control salivation) with or without morphia. The animal is much easier to handle if from one half to one and a half grains of morphine sulphate, according to the weight of the animal, are injected a half hour before operating. The dog is tied securely on to the table in the ventral recumbent position. Enough ether is administered to render the animal entirely unconscious. If desired, the use of ether may be avoided by spraying a 1 per cent. solution of novocaine into the mouth over the tongue and down into the larynx, but as a rule ether anesthetization is more satisfactory. The loops of wicking (G and G′) are quickly slipped into the dog's mouth, the buckles pushed against the muzzle, and the wicking is then pulled tight so that the jaws are opened as far as possible. It is fastened by tying in a knot between D and D′ and between E and E′, unless clamps have been used to hold it. The dog's tongue is seized with tongue-grasping forceps and is pulled forward. A cord from the screw-eye at F is tied into the handle of the forceps with a slip-knot in order to secure the tongue. The epiglottis is seized with a long pair of tissue-grasping forceps and is drawn forward. The field of operation, the interior of the larynx, is thus exposed and is best illuminated by a headlight. The true or inferior vocal cords appear as whitish membranous folds on the lateral walls, diverging as they extend dorsally. They are separated by a triangular space. Holding the epiglottis forward, the movable blade of a No. 1 or "small" round Hartman tonsil punch (may be obtained either with scissor handle or pistol grip) is inserted lateral to the fold, and as large a section of the vocal cord as possible is removed. The operation is repeated until the entire vocal cord is cut away from the larynx, then the other cord is similarly removed. The removal should be quickly accomplished and in such a manner that no ragged edges or tags of tissue are left. Unless the walls of the larynx are mutilated, bleeding is very slight and is controlled by a cotton swab dipped in a 1 per cent. Dakin's solution. The entire operation must be completed before anesthesia has worn off and the laryngeal walls have become tactually irritable, otherwise a coughing reflex will occur each time the lining of the larynx is touched. The clamp on the epiglottis is removed, the tongue is released and the animal is allowed to recover from the anesthesia. No further treatment is necessary.

There has never been, in any of my cases, interference with deglutition because of laryngeal relaxation after cutting the vocal cords. The animals eat normally from the day after the operation. Their attempts to bark are in no way interfered with, but the only sound they are capable of producing is a muffled hissing sound, scarcely audible in the next room.

JUSTIN M. ANDREWS

JOHNS HOPKINS SCHOOL OF HYGIENE AND PUBLIC HEALTH

SPECIAL ARTICLES

ALUMINUM HYDROXIDE AND THE "FREEZING UP" OF ALKALI SOILS DURING RECLAMATION

IN the cultivation of irrigated soils in the west and southwest the chief adverse factor encountered is "alkali" (the presence of chlorides, sulfates and carbonates of sodium, and to a lesser extent, the chlorides and sulfates of calcium and magnesium). These soluble salts may have been present from the beginning or they may have been brought in by the use of saline irrigation waters. Large tracts of once productive lands are to-day alkali wastes, due to over-irrigation and seepage. During recent years reclamation measures on a large scale have been undertaken in many sections of California, Arizona, Utah and New Mexico. The common procedure has been to erect dykes or "borders," and apply large amounts of irrigation water to leach out the salts and permanently remove them from the land through under-drainage. In order for this procedure to be successful, it is, of course, necessary that the soils "take water" readily, *i.e.*, that good drainage be maintained throughout the washing process. It is a matter of common knowledge that water percolates freely through soils as long as they contain relatively large amounts of salts. When the solutes have been largely reduced, however, unless the irrigation water contains soluble calcium, the rate of percolation rapidly falls off and often reaches a point at which downward water movement ceases. In the words of the farmer, the soil "freezes up." When finally dried, such soils are hard, puddled and unfit for cultivation, and when rewetted "run together" and refuse to "take water." In fact, they are in worse physical condition than before reclamation operations were begun.

This "freezing up" of the soil has put an end to many alkali reclamation projects and has stimulated extensive investigation by soil chemists in arid countries. A number of theories have been advanced, but the "freezing up" is still unexplained. Recent contributions to the chemistry of alkali soils have added greatly to our understanding of the chemical reactions associated with the formation and properties of such types. We have reference to the work on soil zeolites by both American and European investigators. Some have given the impression that the soil zeolites (basic hydrated aluminum silicates) were directly associated with this phenomenon. It has been shown by two of the authors that the ratio of replaceable sodium to replaceable calcium has little or nothing to do with soil dispersion, also that the absolute amounts of sodium zeolite present bear little relationship to rate of percolation or degree of permeability.

As the concentration of sodium salts in the soil solution is reduced by leaching, the hydrolysis of the sodium zeolites present in varying proportions in all alkali soils yields hydroxyl ions in ever increasing amounts. The soil thus becomes more alkaline, and there has been much discussion as to whether the cation or anion is chiefly concerned in the accompanying increased dispersion. While the direct relationship of concentration of sodium zeolite or of sodium or hydroxyl ions to dispersion is open to question, it must be admitted that dispersion follows the hydrolysis and subsequent ionization of the sodium zeolite.

In soil investigations the amphoteric character of aluminum has rarely been considered. This element ionizes as a base when its normal salts are dissolved in water, and by hydrolysis yields an acid solution. On the other hand, it exhibits acidic properties, as the complex aluminate ion, when its solutions are made strongly alkaline, or when the hydroxide is dissolved in the solution of a strong base. Furthermore, the solution of any soluble aluminate always reacts alkaline due to hydrolysis, as shown in the following equation:

$$NaAlO_2 + 2H_2O \rightleftarrows NaOH + Al(OH)_3$$

Within the range of reaction represented by pH 5 to 7.5 aluminum as the hydroxide is practically insoluble while above pH 8 its solubility as sodium aluminate rapidly increases. The latter may be considered just as truly a salt solution as borate or arsenate solutions, or as the normal acid aluminum salt solutions at reactions below pH 4. The physical properties of aluminum hydroxide vary greatly according to the conditions under which it is formed, being most colloidal when precipitated from dilute solutions and in the cold. Furthermore, the hydroxide may be formed both by reducing the alkalinity of an aluminate solution or by adding alkali to an acid aluminum-salt solution.

There is a definite difference between base replacement, soil reaction, colloidal dispersion and aluminum-hydroxide precipitation, although they all play an important part in the "freezing up" of soils during the reclamation process. It has been shown by us that this "freezing up" phenomenon is due to the precipitation of colloidal aluminum hydroxide within the washed soil complex simultaneously with the almost complete dispersion of the clay fraction, as the alkalinity is progressively reduced below pH 9.5 to 10. As will be seen, both the precipitation and the dispersion are largely governed by the reaction. The mechanism of the precipitation process is as follows: As we wash a highly saline soil, when the concentration of the sodium salts approaches a minimum, the alkalinity rapidly increases due to the formation of

sodium hydroxide by progressive replacement and hydrolysis of sodium zeolite. The sodium hydroxide, in turn, brings soil aluminum into solution as aluminate. On continued washing, the alkalinity is reduced. With this progressive reduction in OH-ion concentration, proportionally larger amounts of aluminum hydroxide are formed, accompanied by a corresponding reduction of the soluble aluminate. This, together with the almost complete dispersion of the clay colloids at these alkalinities, renders the soil practically impervious to water or air. As an example of such a soil we cite the case of an Arizona date orchard soil which before leaching was high in salines and gave a reaction of pH 8.8. After leaching out most of the neutral salts it showed a reaction of pH 11.05. The excess of aluminate over aluminum hydroxide is at a maximum at this latter reaction, but as the leaching operations were continued, the precipitation of aluminum hydroxide progressively increased with the lowered OH-ion concentration, and the soil finally became impermeable. Where "black alkali" soils (soils carrying sodium carbonate) are being reclaimed by leaching, the "freezing up" occurs as soon as the excessive alkalinity has been reduced to the precipitation point of aluminum hydroxide. Percolates from many "black alkali" soils have been examined and all show appreciable amounts of soluble aluminum as aluminate.

In our investigations to date we have obtained soluble aluminum by dialyzing black alkali soils. We have reproduced the "freezing up" phenomenon by the action of aluminum chloride solutions on an alkali soil of pH 10 in which the precipitation of aluminum hydroxide was produced by the reaction of the alkali within the soil. This was demonstrated by standing one-inch glass tubes of alkali soil in beakers of aluminum chloride solution of different normalities, noting the rate and height of capillary water movement, by the quantitative determination of the aluminum hydroxide deposited and by measuring the pH of the soil at varying heights in the soil column. Similar experiments were made with silica sand to which calcium carbonate and sodium carbonate had been added and similar results were obtained.

We further demonstrated the "freezing up" properties of aluminum hydroxide by mixing sodium aluminate with a neutral soil, placing in percolators, saturating with water, allowing the whole to stand several days for the reactions to come to equilibrium, and then percolating with water. In this case the precipitation was brought about by reducing the alkalinity of the aluminate. We have also determined the precipitation range of aluminum hydroxide by electrometric titration experiments and studied the properties of the aluminates formed. These experiments not only showed a high solubility for sodium aluminate but also indicated that the solubility of calcium aluminate was appreciable at reactions usually found in alkali soils.

Further work has been done which correlates certain well-known peculiarities of aluminum hydroxide with soil behavior under reclamation. For example, if pure aluminum hydroxide is precipitated in a cold solution the precipitate is colloidal and filters very slowly. If, however, the precipitation is made in a hot solution, it is more granular and filters readily. When alkali soils are leached with cold water, they usually "freeze up" in a very short time. It has been found that, if these same soils are leached with hot water, they do not "freeze up," but percolate indefinitely.

If pure aluminum hydroxide is allowed to become perfectly dry it loses many of its colloidal properties which can not be restored fully by wetting or by pulverizing. We have shown that, if a "black alkali" soil is leached with pure water until it becomes impermeable and then dried out and cultivated, it takes water much more readily. The practical significance of this phenomenon is emphasized.

A complete discussion of this work, together with the numerical data obtained, will appear soon as Technical Bulletin No. 11 of the Arizona Agricultural Experiment Station.

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THE ACTIVATION OF MOLECULAR HYDROGEN BY ELECTRON IMPACT

The activation of molecular hydrogen by electron impact has been carried out under conditions in which the energy of the impinging electrons was known. The measurements were made in a four-electrode tube containing filament, grids and plate in the usual manner. A cylinder of copper oxide surrounding the space between the grids gave the activated hydrogen an opportunity to react. The water formed was frozen out in a liquid-air trap. The resulting pressure decrease was determined as a function of the accelerating voltage applied to the electron stream leaving the filament, and it was found that a sharp decrease in pressure occurs when electrons of 11.4 volts energy impinge on hydrogen molecules.

At the same time current-potential curves were taken by the Franck method and a kink in this curve occurred at the same voltage at which the pressure in the apparatus began to decrease.

The latest results of spectroscopy show that the

hydrogen molecule has a resonance potential at 11.6 volts. The present results therefore show that hydrogen molecules can be made to react at ordinary temperatures with copper oxide after they have been brought into their first higher quantum state by electron impact.

A detailed account of these experiments will be given in another place in collaboration with W. P. Baxter and R. H. Dalton.

GEORGE GLOCKLER
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THE NATIONAL ACADEMY OF SCIENCES

At the autumn meeting of the National Academy of Sciences held in Philadelphia on November 8 and 9 the following papers were presented:

New proofs of solar variation: C. G. ABBOT.

Various critics having recently expressed themselves as unconvinced of the validity of the proofs of solar variation either in long or short intervals, it occurred to the author to test the matter in a new way.

The difficulty which the critics find inheres in the fact that the observer is situated underneath the ocean of atmosphere whose influence in diminishing the intensity of solar radiation must be allowed for. Since the atmosphere contains variable constituents, critics are doubtful as to whether the apparent variations of solar radiation are really solar or are due to atmospheric variations which the observer is unable to eliminate.

If the observer were situated on the moon, with no atmosphere interposing, accurate direct measurements of the intensity of solar radiation, when compared from time to time, would furnish true indications of the solar variability. Similarly, if the observer underneath the atmosphere of the earth could restrict his measurements to instants when the transparency of the atmosphere is identically the same, such a selective series of observations would also give the true solar variability.

The author attempts to realize this latter condition, in the first place by confining data to months of the same name in successive years. In this way temperature variations of the apparatus, the surroundings, and the atmosphere are minimized, and possibly yearly periodicities in the sensitiveness of the apparatus are eliminated. Secondly, the measurements are chosen always with the sun equally high above the horizon, so that the thickness of the air traversed is the same. Thirdly, days are selected in which the total atmospheric humidity as observed spectroscopically is identical. And fourthly, days are selected when the apparent transparency of the atmosphere as indicated by observations at different air-masses is nearly identical.

The author exhibited results for the month of July in the years 1910 to 1920, as obtained at Mount Wilson, Calif., and results for the twelve months for the years 1920 to 1925, as obtained at Mount Montezuma, Chile. Both series indicated real variations of the sun which were in close agreement with the variations already found for corresponding days by solar constant measurements. Both series indicated that higher solar radiation prevails at times of numerous sunspots.

Forty years of Blue Hill Observatory: Precipitation. E. B. WILSON.

A Pneumatic-drive method for measuring the fatigue of metals at high frequencies: L. J. BRIGGS and D. H. STROTHER (introduced by George K. Burgess).

The vibration of a flat bar with free ends mounted on pivots at its nodal points is maintained by a pneumatic drive, consisting of nozzles ending in flat discs which are mounted adjustably near the nodal points. The air escaping through the narrow space between the disc and the flat bar causes a reduction in pressure in this space, so that the bar is forced toward the disc. This force (which varies with the distance between disc and bar) operating in conjunction with the elastic restoring force and the inertia of the system keeps the bar in vibration at its natural frequency. The extreme fiber stress may be computed from Rayleigh's theory of a free bar in vibration if the amplitude and the dimensions of the bar are known. Alternating fiber stresses of 15,000 lbs/in.^{2} at frequencies of 200 cycles per second have been continuously maintained in duralumin bars until failure occurred near the center of the bar.

Note on the thermodynamics and kinetics of gaseous explosive reactions: F. W. STEVENS (introduced by George K. Burgess).

A condition under which the gaseous explosive reaction may run its course at constant pressure, greatly simplifies the processes of the explosive reaction, as it simplifies those of the ordinary reaction, by eliminating a number of variables: A constant pressure insures a constant concentration of the initial gaseous components the zone of the reaction is entering. This condition is found to result in a constant linear rate of propagation of the zone of reaction within the explosive gases; a constant reaction process within, and hence a constant temperature gradient across this zone; and a constant temperature and composition of the reaction products as they leave this zone. To secure a condition of constant pressure under which the explosive gaseous reaction may run its course is, therefore, to bring its processes and hence the experimental methods for their study and analysis to a degree of simplicity and precision comparable to those met with in the study of the gaseous reaction at constant pressure and temperature below their ignition point.

This favorable condition for the gaseous explosive reaction—a constant pressure—may be closely realized in practice by holding temporarily the explosive gases within a soap-film container and firing the bubble from the center. This simple device functions as a bomb of constant pressure and thus provides the complement to the bomb of constant volume in the relation $p\ v = nRT$.

Being transparent, it permits an accurate photographic time-volume record of the reaction to be secured. This record, for thermodynamic studies, gives the initial volume of known concentrations and, at the instant the explosive action is completed, it gives the volume of the equilibrium products. This final volume corresponds to the reaction constant

$$K=\frac{[A^1]^{n_1^1}\ [B^1]^{n_2^1}\ [C^1]^{n_3^1}\ldots\ldots}{[A\,]^{n_1}\ [B\,]^{n_2}\ [C\,]^{n_3}\ldots\ldots}$$

Because the concentrations of the explosive gases remain constant, during the reaction, under the condition of constant pressure, it is found that the rate of propagation of the zone of reaction relative to these gases also remains constant and its value,

$$s=k.[A]^{n1}\ [B]^{n2}\ [C]^{n3}\ldots\ldots,$$

is proportional to the product of the initial concentrations of the gases.

Luminescence due to radio-activity: D. H. Kabakjian (introduced by Edgar F. Smith).

Luminescence of radio-active compounds is well known. The nature of this luminescence has been made the subject of numerous researches and a number of theories have been advanced to explain the observed phenomena. These are mentioned. It is shown that none of these theories are wholly adequate to explain all the known facts. Experiments and researches conducted in this laboratory are described and the results are discussed in connection with the theories already advanced. The discrepancies are pointed out but no new theories are given. Experiments are shown in radio-luminescence and thermo-luminescence.

Recent measurements of the velocity of light: A. A. Michelson.

The experiments described are a continuation of the work reported to the academy a year ago. The results of five series of observations with revolving mirrors having 8, 12 and 16 facets showed a remarkable agreement, and gave as a final result for the velocity of light between Mt. Wilson and Mt. San Antonio, 299,796 kilometers per second.

Transformations of manifolds: S. Lefschetz.

An n dimensional manifold M_n is a locally homogeneous configuration built up by means of a finite number of non-interpenetrating n dimensional pyramids. The enumeration of the fixed points of the continuous transformations of M_n into itself or part of itself is of well known importance and has been treated by many authors. The more general problem of the number of coincidence points of two transformations T, T^1 (points with a common transform by T and T^1) has been considered only for algebraic curves. The enumeration for reasons inherent to the problem is carried out by "weighing" the points with positive and negative integers and adding these. Their sum N is characteristic of classes, rather than of individual, transformations. By means of an associated M_{2n} we have determined N in terms of the matrices describing the effect of the transformations of M_n on its cycles. These matrices are class invariants and the formulas obtained correspond to the most general situations possible. They include as very special cases whatever else has been obtained hitherto along that line —they do not cover such specialized transformations within a given class as were considered by Poincaré in his famous ring problem so elegantly solved by Birkhoff.

The density of oxygen and its compressibility below one atmosphere: G. P. Baxter and H. W. Starkweather.

Continuing earlier work presented to the academy further determinations of the density of oxygen have been made with two liter globes. The average density at 0° and one normal atmosphere, 1.42896, agrees closely with that found earlier with one liter globes, 1.42898.

The compressibility was found by density determinations with two liter globes at three quarters, one half and one quarter atmosphere with the following results:

	Density
¾ atmosphere	1.07148
½ atmosphere	0.71415
¼ atmosphere	0.35699

The deviation from Avogadro's rule between 0 and 1 atmosphere calculated from these values is 1.00095 and the limiting value of molal volume is 22.415.

The density, compressibility and atomic weight of nitrogen: G. P. Baxter and H. W. Starkweather.

The density of nitrogen has been determined with two liter globes at one, two thirds and one third atmosphere, with gas prepared from ammonium nitrite and by oxidation of ammonia. The following results are referred to 0° and the normal atmosphere.

	Density
1 atmosphere	1.25036
⅔ atmosphere	0.83348
⅓ atmosphere	0.41667

The deviation from Avogadro's rule calculated from these values is 1.00050 and by combination with the results for oxygen the atomic weight of nitrogen is found to be 14.007.

The apparition dates of the Andromede or (Bielid) meteor swarms: Willard G. Fisher (communicated by Harlow Shapley).

The apparition dates of the Andromede swarms, from 1741 to the present, have hitherto seemed to show almost no system. In the following paper, the dates found in a search of the literature have been reduced to the equinox of 1850 by the method of H. A. Newton, and tabulated; and the tabulation is exhibited graphically.

The points, plotted with year of apparition as abscissas, "1850 dates" as ordinates, tend to group themselves, not in a single line, but in a band, which displays a general regression of the nodes where earth meets swarms. Three (or four) of the points lie distinctly outside of this band. Nine of the nineteen points in this

band lie on three straight lines, which converge to the "1850 date," 1935 November 16; while most of the others are related to the nine as subsidiary apparitions, not maxima, or are close to one or another line.

This convergence may be pure chance; or it may indicate some approaching meteoric event. In either case, two additional tables show close relations between the doubled period of Biela's comet and the intervals between apparitions.

A decade of eclipse observations: JOHN A. MILLER (introduced by C. E. McClung).

The paper is a brief summary of the observations made and the results obtained by eclipse observers during the last decade. A great many large scale photographs of the corona have been made. A study of them shows that the material of the corona moves and that the motion is sufficient to be detected by comparisons of plates made at stations at widely different longitudes. This motion has also been found by a study of the Fraunhofer spectrum of the corona. Excellent results have been obtained with photometers and with thermo couples. "Flash" spectra have been made of hitherto unexplored regions of the "flash" spectrum. All observations made to test the deflection of the light as predicted by Einstein have been made in this decade.

The method of dependencies for solving equations, with an application to photographic positions of asteroids, etc.: FRANK SCHLESINGER.

This method is applicable to the case where the chief interest of the computer is some function of the unknowns involved in the original equations. The dependencies are factors which when applied to the observed quantities (and the products are added) give the desired function. A simple method for deriving these dependencies in the case of linear relations is given and some interesting properties of them are discussed.

Family traits as determined by heredity and environment: FRANZ BOAS.

The paper dealt with the discussion of the determination of bodily form by inheritance and the degree of similarity in fraternities. The variability of family lines will be discussed and the attempt is made to show that it can not be explained by heredity alone but that environmental influences have to be taken into consideration.

Some physical characteristics of the American Negro population: MELVILLE J. HERSKOVITS (introduced by Professor Franz Boas).

Studies of the physical anthropology of the American Negro show, after a number of generations of crossing, the formation of a relatively definite type. This type in spite of its heterozygous character, is quite homogeneous, and has been effected by a social selective mechanism involving the desirability of Caucasoid traits, dark men choosing light-colored wives. It is important, however, to investigate differences within this population which occur with differing environments, various places of birth, and different occupations, and such differences are analyzed in this paper.

Elden Pueblo: J. WALTER FEWKES.

The object of the communication was to announce the discovery, by archeological methods, of a prehistoric pueblo which had never been described. This ancient pueblo is situated six miles east of Flagstaff, Arizona, and about two hundred yards west of the National Trail Highway. An attempt is made to indicate the affinities of its former inhabitants as shown by the objects found illustrating the arts and customs of these people.

This pueblo was excavated during the period from June to September of the present year. It was practically unknown to any scientific man before May, although the artificial appearance of the clearing in the pines had been recognized as the site of a settlement from the time Flagstaff was settled by the white people.

The name "Elden Pueblo" was given to the ruin by the author on account of its neighborhood to Elden Mesa, an eastern spur of the San Francisco Mountains. Its form is rectangular in shape, oriented north and south, measuring one hundred and fifty feet long by about one hundred and twenty-five feet wide. It contains one ceremonial room corresponding to a kiva, which was used for councils and religious purposes. The masonry of the walls is perhaps the crudest of that of all the pueblos. Many of the stones that formed the walls were megaliths, unworked and set on edge. It was found necessary to cement the top of the walls in order to prevent the water from percolating through the structure; in this way the rocks were fastened in place; only a few of them were squared or set in serries. Apparently the wall of the structure was two stories high, and with the exception of one opening there were no lateral entrances.

A Pliocene bear from Oregon: JOHN C. MERRIAM and CHESTER STOCK.

The history of the bear group in America is of exceptional interest, both by reason of continuity and evolution in the geological history of this group, and because of the bearing of the biological aspect of this problem upon questions concerning geographical history of the northern hemisphere.

Numerous specimens representing the bear group in the three geological periods preceding the present have been found in the last few years in America. A specimen of exceptional interest discovered in connection with the paleontological and geological work in eastern Oregon furnishes new information regarding relationship of American bears to those of the Old World, and is of much importance in determining the geological age and relationships of one of the best known units in the geological sequence of eastern Oregon.

The embryology of Amphioxus and the equipotential theory of development: EDWIN G. CONKLIN.

The general result of these studies on the normal and experimental embryology of Amphioxus is to show (1)

that the localization pattern in the egg and embryo is essentially the same in Amphioxus, ascidians and amphibians, (2) that while the power of regulation is greater in Amphioxus and amphibians than in ascidians, in none of these do posterior blastomeres give rise to neural plate, notochord or elongated embryos, (3) in all of these chordates anterior blastomeres may develop neural plate, notochord and elongated embryos, but in ascidians and amphioxus, at least, such embryos are deficient in mesoderm, (4) in no case of isolated or partially isolated blastomeres of Amphioxus or ascidians is there any evidence that the intrinsic axes and polarity have been changed. (5) Finally, the potency of individual blastomeres is determined by their material substances and not by immaterial entelechies.

An experimental study of organization in the egg: D. H. TENNENT (introduced by C. E. McClung).

The work of which this is a brief report was begun by C. V. Taylor and D. H. Tennent at Hopkins Marine Station, Pacific Grove, Calif., in 1923, and continued by them during the summer of 1924 at the Tortugas Laboratory of the Carnegie Institution of Washington. It was brought to its present form by C. V. Taylor, D. H. Tennent and D. M. Whitaker, at Tortugas during the summer of 1926.

In 1901 Boveri showed that in eggs of the sea urchin *Paracentrotus lividus* scattered pigment became concentrated, during maturation, in a ringlike zone lying in the vegetative half of the egg and standing at right angles to the egg axis. Boveri concluded that the vegetative, unpigmented cap furnishes the primary mesenchyme, that the pigmented zone forms the intestine and its derivatives, and that the unpigmented animal half gives rise to the ectoderm.

It has been very generally inferred that a similar zone exists in the eggs of other sea urchins, although it is not made visible by the localization of pigment, and that this zone separates the animal half, containing potential ectoderm, from a vegetative cap of micromere-forming material.

Our experiments show conclusively that in the egg of the sea urchin *Lytechinus variegatus* there is no localization of micromere-forming material before fertilization, and that although the micromeres may be separated by the fourth cleavage at the definitive vegetal pole of the egg, the material thus separated has neither been in position as a polar cap, nor has it had any other localized distribution.

By means of Taylor's apparatus, eggs were cut in any plane desired, giving a pair of fragments, one nucleated, the other non-nucleated. Both members of a pair were then fertilized, and kept under continuous observation throughout critical cleavage stages. Many of these pairs were also reared to blastulae, gastrulae and plutei for evidence on later processes of development.

The evidence indicates an epigenetic development of micromere-forming substance from material from which both ectoderm and endoderm are differentiated. The number and relative distribution of micromeres is independent of the plane of section, and within limits, of the size of the fragment. The number and distribution of micromeres is not dependent on the n or $2n$ quantity of nuclear material. The orientation of the cleavage planes, the place of formation of the micromeres, and the place of invagination of the archenteron indicate that the definitive polarity of the egg fragments is in an axis lying at right angles to the surface of section. Micromeres are formed and the archenteron invaginates from the newly established vegetative pole.

General principles of the relation between growth and behavior in vertebrates: G. E. COGHILL (introduced by Henry H. Donaldson).

Growth is here regarded, not in the phase of change in size or mass, but as progressive change in structure, or, technically, cytomorphosis. In this sense growth within the nervous system causes progressive development of behavior. This has been demonstrated in studies on Amblystoma. Upon the basis of the results of these studies correlated with facts from other sources the following conclusions may be stated as general principles underlying the development of behavior in vertebrates.

1. Growth of the nervous system before nervous functions begin is localized in definite foci, and these become centers of control of the behavior pattern of relatively advanced or even adult life.

2. The growth of nerve cells into non-functional or nascent organs while these same nerve cells are functioning in an earlier behavior pattern compels the earliest movements of such organs to be, not local reflexes of the adult type, but inseparable components of the total behavior pattern of the individual.

3. The individuation of organs and organ-systems out of the total behavior pattern into discrete systems of specialized function is anticipated in the central nervous system by the growth of elaborate mechanisms for the integration of their functions.

4. In the early phases of the development of behavior the individual is possessed of nervous organization far beyond that which is required for its immediate capacity to react to or upon its environment; and the degree of this "forward reference" to behavior in the growth of the nervous system in embryonic and later life appears to be, at least in a general way, directly proportional to the learning capacity of the species.

5. These conclusions or principles point to growth as the creative function of the nervous system.

Mammalian growth curves: C. B. DAVENPORT.

The comparison of curves of growth increments in guinea pig, rat and mouse show that, as in the case of man, there is a circumnatal spurt, of great velocity, which reaches its climax just as the placental connection with the mother is severed.

This is followed by a decline in the rate of growth for three or four days which represents the period of adjustment to terrestrial life. This is quickly followed by a return to the standard velocity of growth which in the rat, but not in the guinea pig, is greater, though only slightly greater, than the circumnatal velocity.

In all cases the velocity of growth soon thereafter de-

clines to a minimum which, in the case of the guinea pig, is about 42 days, in the case of the rat 9 days, in the case of the mouse 7 days. This minimum corresponds to that which recurs at 3 years in the human child.

But whilst in the human infant some 7 years elapses before the adolescent spurt starts, in the case of the 3 rodents that spurt begins without delay. The crest of this spurt coincides with the beginning of sexual maturity. It stands, in the guinea pig at about 70 days, in the rat about 50 days, in the mouse at about 25 days.

The maximum length of the ordinary human life span may be taken as 295 hundred days, that of the guinea pig at 15 hundred and that of the mice as 10 hundred days. Reducing these life spans each 100 per cent., we may determine the percentage of the whole constituted by each of 4 periods; namely, intrauterine, prepubertal, reproductive and senescent. The most striking contrast in this comparison is the prepubertal life of the child—relatively 2 or 3 times as long as in the other mammals plotted. The second outstanding fact is that the reproductive period in man is relatively short, only about two thirds that of the mouse. On the other hand, man's post-productive period is correspondingly prolonged.

Thus, as compared with some other mammals, man has a relatively brief intrauterine life, a long childhood, a brief reproductive period and a long post-reproductive period. Evidently this result permits of prolonged training for the period of maturity when a man's best work is done. It tends to lead man to minimize the real importance of reproduction to the species. It tends to emphasize training and achievement and the accumulation and transmission to the next generation of the results of experience which are possible where life is prolonged beyond the reproductive period. The tendency of modern, intensive professional training and the stress on economic status is to extend the pre-reproductive period throughout the first third of life, so that practically only about 25 per cent. of the maximum life span is available for reproduction.

The high development of the human species in matters economic, social and intellectual has been favored by his slow development and brief reproductive period. The pressure for development on the social and economic sides in the intellectually more advanced biotypes of Homo sapiens cuts into the reproductive period so deeply as greatly to handicap the numerical strength of that biotype in the population; indeed it constantly threatens to result in the extermination of that biotype.

The synthesis of isomers of proflavine and of neutral acriflavine: M. T. Bogert and P. G. I. Lauffer.

Proflavine base (2, 8-diamino acridine) and Neutral Acriflavine 2, 8-diamino-10-methylacridinium chloride) have proven to be valuable bactericides and general antiseptics, and were used with considerable success during the recent war and in the treatment of wounds. It was thought of interest, therefore, to prepare isomeric compounds in which the amino groups were para and not meta to the acridine N, and we have synthesized the 3, 7-diamino derivatives by the following series of reactions: o-chlorobenzoic acid → 2-chloro-5-nitrobenzoic acid → 2- (p-nitrophenylamino)-5-nitrobenzoic acid → 3, 7-dinitro acridone → 3, 7-diamino acridone → 3, 7-diamino acridine (Proflavine isomer) → 3, 7-diacetylamino acridine → 3, 7-diacetylamino-10-methylacridinium methyl sulfate → 3, 7-diamino-10-methylacridinium chloride (Neutral Acriflavine isomer). These new products are now being tested pharmacologically by Professors Hirschfelder, of the University of Minnesota, and Lavis, of the University of Nebraska.

The electrolytic dissociation of water in salt solutions: Herbert S. Harned (introduced by Edgar F. Smith).

A method is outlined for evaluating the activity coefficient and ionic concentration products of the hydrogen and hydroxyl ions in aqueous salt solutions.

It is shown that the dissociation of water increases rapidly, passes through a maximum value and then decreases upon salt addition. The dissociation of water at a given salt concentration is greatest in the solution of the electrolyte which possesses the highest activity coefficient. By comparison with values obtained for the dissociation of formic acid in salt solutions, it would seem that weak acids and bases may all behave in a similar manner.

Fluo-germanates of the univalent metals: John H. Muller (introduced by Edgar F. Smith).

Review of the literature of germanium shows that salts of the hypothetical acid $H_2Ge F_6$, with the single exception of the potassium salt, have not been hitherto prepared. The complete series of the alkali metal fluogermanates and the corresponding compounds thallous thallium and silver are described together with methods of analysis of these new compounds and determination of their respective densities, melting points and solubilities.

All these salts are beautifully crystalline and colorless, those of sodium, potassium, rubidium and caesium are much more soluble in hot than in cold water and may be easily purified by recrystallization from hot water on cooling. On the other hand the lithium, thallous and silver salts are so soluble even in cold water that their preparation in crystalline condition is much more difficult. The silver salt is peculiar insofar as it is soluble in water in all proportions near its melting point (80°) and dissolves in about its own weight of water at 30°.

All the alkali fluogermanates are remarkably stable and in aqueous solution are entirely undecomposed by hydrogen sulphide both in presence and absence of free hydrofluoric acid or in dilute or concentrated solution. This would indicate of course that the anion of fluogermanic acid is a rather firmly bound complex, incapable of yielding the germanium ion in solutions of its salts.

It should be stated that Dr. R. W. G. Wyckoff, of the Geophysical Laboratory in Washington, has undertaken the X-ray spectral examination of these new salts and through his kind cooperation has already shown that caesium fluogermanate differs strikingly from its potassium analogue in possessing a cubic structure. Similar measurement of the other members of the group will undoubtedly make their preparation well worth while.

(To be continued)